MAINTENANCE MANUAL
RADIO
FRONT ASSEMBLY
19D902177G7 (SCAN)

TABLE OF CONTENTS

ILLUSTRATIONS

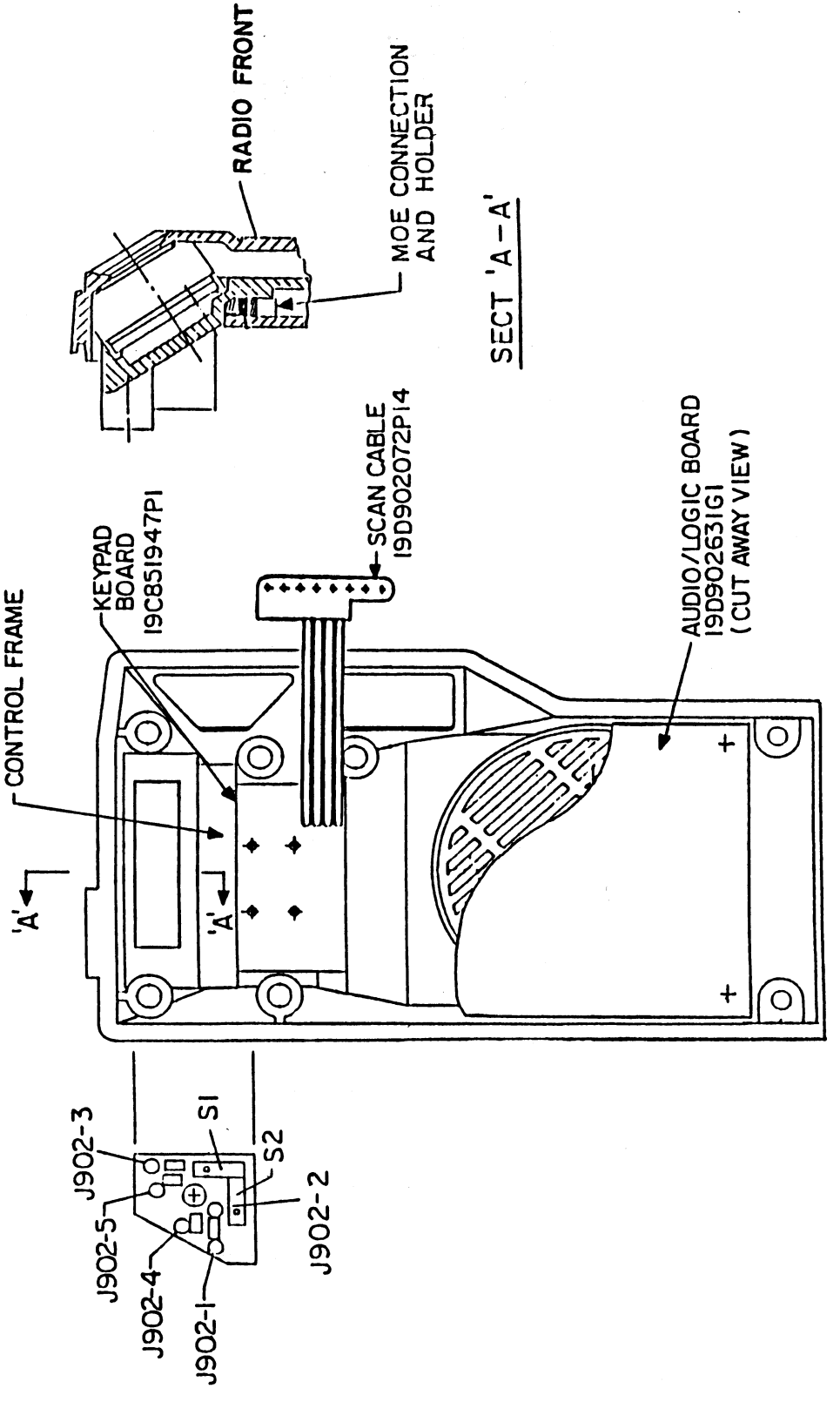

Figure 1 - Radio Front Assembly

DESCRIPTION

The Radio Front Assembly (19D902177G7) for the PCS Scan Personal Synthesized Radio consists of the following:

- Front Cap Assembly 19D902180G4
- Audio/Logic Board 19D902631G1
- Metal Over Elastomer (**MOE**) Connector 19A705662P1 and Holder 19B801570P2

The Front Cap Assembly consists of a LEXAN front housing, a control assembly and a speaker.

The control assembly houses most operator switches, Liquid Crystal Display (**LCD**) and microphone. The Metal Over Elastomer Connector provides the interface between the printed runs on the control assembly and the printed runs on the Audio/Logic board.

The front housing contains the Scan board that mounts the scan push-button.

FRONT CAP ASSEMBLY

Front Cap Assembly 19D902180G4 consists of a molded plastic circuit board (Control Frame), a Liquid Crystal Display (**LCD**) assembly, switches for the basic radio functions and a User Device Connector (**UDC**) all mounted in a plastic front housing.

The Assembly Diagram listed in the Table of Contents shows both a pictorial view of the Control Assembly, and a view of the Control Assembly mounted into the radio front housing. The Control Frame acts like a three dimensional printed circuit board.

The base material consists of "**ULTEM**" molded plastic with a two layer printed circuit pattern on the outside perimeter of the frame. The Control Frame interfaces with the following:

- Control Switches
- Liquid Crystal Display Module (LCD)
- Microphone
- Speaker
- User Device Connector (UDC)

AUDIO/LOGIC BOARD

Audio/Logic Board 19D902631G1 mounts in the Front Cap Assembly as shown in Figure 1. All Front Cap control switch operations are connected to the Audio/Logic Board through the MOE interface connector. The scan push-button board is connected by a cable to J802 on the Audio/Logic board.

A microprocessor on the Audio/Logic Board interprets these commands and issues commands to the Audio/Logic circuits, the RF circuits and the LCD module on the control assembly. Microphone and speaker audio is also transferred through the MOE connector.

Refer to Figure 2 for a block diagram of the microprocessor and associated circuitry, and to Figure 3 for a block diagram of the audio paths (see Table of Contents).

The Audio/Logic Board consists primarily of the following:

- Microprocessor
- EEPROM
- RX Audio Processing
- TX Audio Processing
- Regulators and Special Circuits

CIRCUIT ANALYSIS

FRONT CAP ASSEMBLY

Control Switches

The control switches include the PTT, **MON**itor, **CHAN**nel Up/Down, and **VOL**ume Up/Down controls. A "**Dome**" switch pad adheres to the control frame with domed metal switches. When pressed, these switches make direct contact with runs on the control frame. A rubber keypad fits over the switch assembly for operator interface and weather protection.

Scan Switches

The scan push-button switches consist of the **ADD/HOME, SCAN** and **DEL**ete buttons mounted on a small printed wiring board. Pressing these switches makes contact with the runs on the board. These lines are connected to the Audio/Logic Board by a cable that plugs into the Audio/Logic Board.

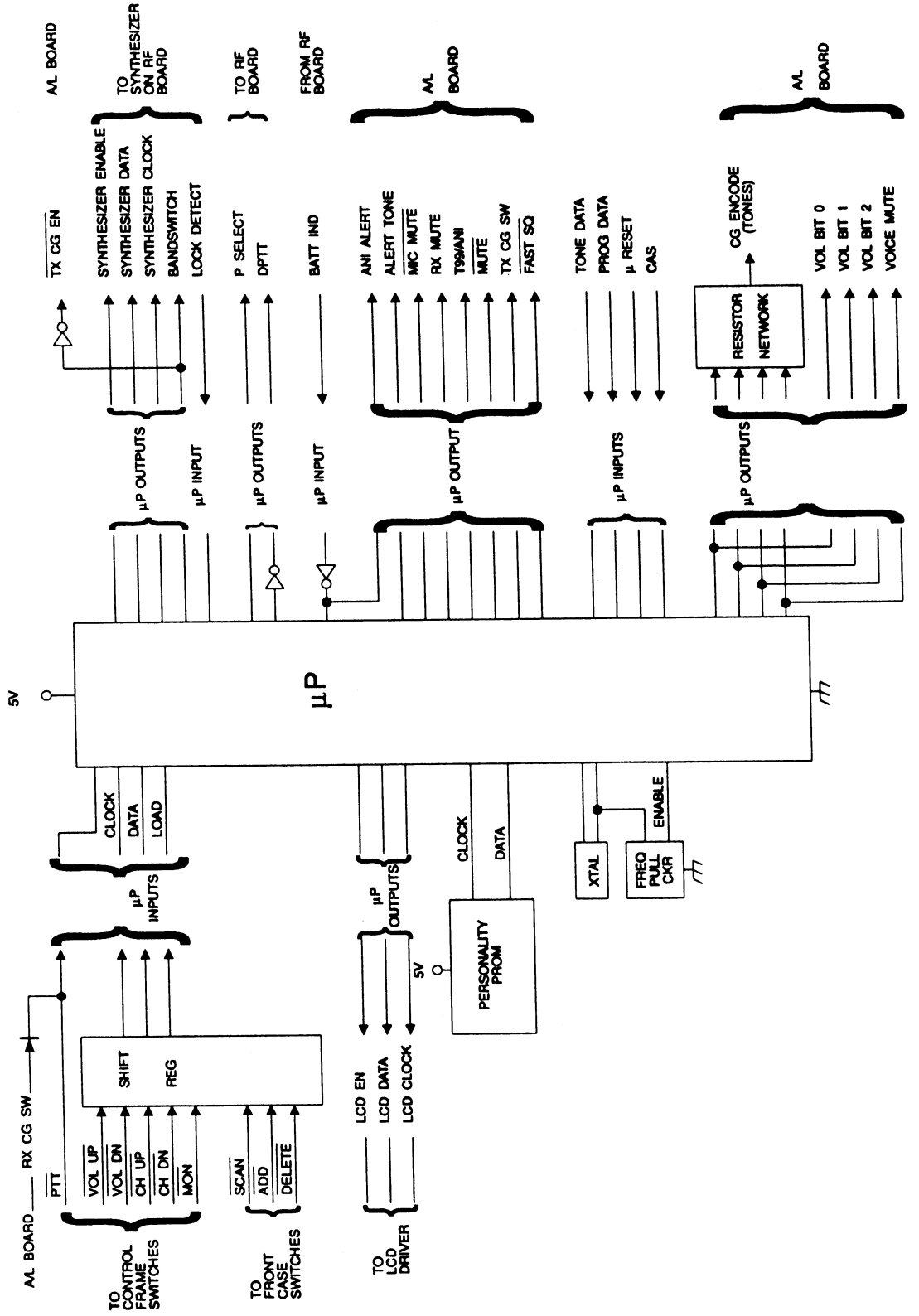

Figure 2 - Microprocessor Block Diagram

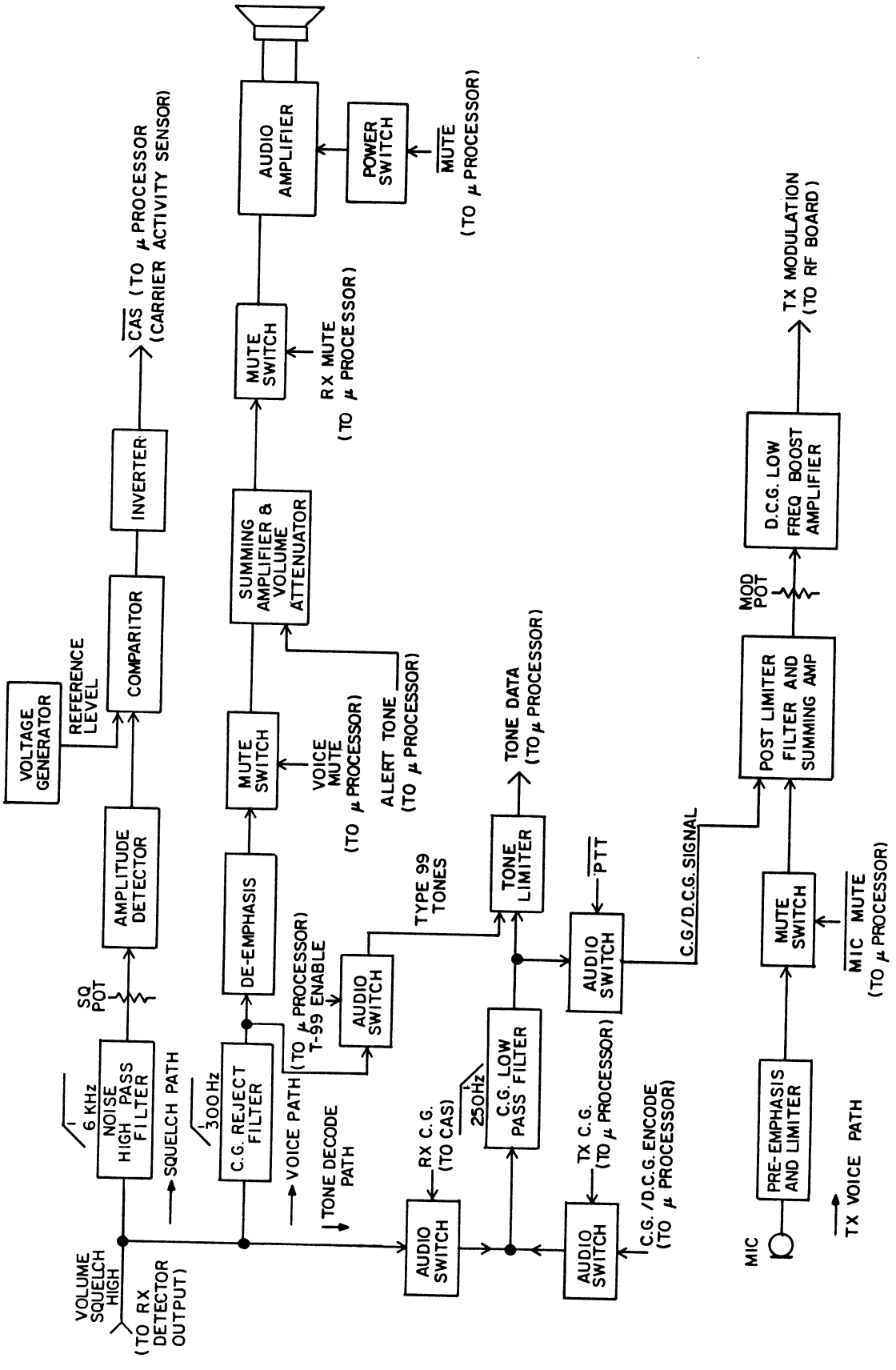

Figure 3 - Audio Paths Block Diagram

Liquid Crystal Display (LCD)

The LCD assembly consists of LCD driver board A1, a diffuser, two zebra strips, the LCD and a lens. The LCD assembly is held together by the lens. The primary function of this board is to light LCD segments as controlled by the radio microprocessor on the Audio/ Logic Board.

Another function of this board is to provide back-lighting of the LCD module. This is accomplished by using four LED devices (D1 - D4). These LED's are turned on by **LCD DAT/LT** line and powered by a voltage switching circuit consisting of chip transistors Q1 and Q2. The diffuser placed immediately above the LED's evenly distributes the light. The zebra strips connect the driver board to the LCD, and the entire assembly plugs into the control frame with six pins.

Microphone And Speaker

The microphone (B901) mounts directly onto the control frame (HL1 and HL2). The control assembly, when placed into the Radio Front Assembly, is located in the correct position for receiving voice when used. The speaker, mounted in the front housing, connects to the control frame (HL3 and HL4) through two wires. A protective grill cloth is placed in the front housing before the speaker is mounted to screen out foreign material.

User Device Connector (UDC)

Part of the control frame forms UDC connector U901 for customer programming and for connecting external options. The speaker leads, mic high and PTT are all brought to this connector along with ground. The mic lead and one of the speaker leads are switched to the UDC only when microswitches S1 and S2 are operated. These switches are activated by plungers on compatible **PCS** Personal Radio options. A rubber boot is placed over this connector for weather protection.

AUDIO/LOGIC BOARD

Microprocessor (80C52)

An 8-bit microprocessor (U1) is used to provide all of the control signals required by the radio. The microprocessor also generates Channel Guard tones, DCG Words, GE Star, ANI Words, and detects Channel Guard and Type 99 tones.

The microprocessor is located on Spur Filter Board A701. The Spur Filter board includes RC filters on each port of the processor, and a metal can soldered on top of the board to reduce the effect of microprocessor-generated spurious signals.

Microprocessor Port Pin Definitions

Port Pins **I** = Input
O = Output
I/O = Bidirectional

P0.0 (O) Channel Guard encode bit 0/Volume attenuator bit 0

P0.1 (O) CG encode bit 1/Volume attenuator bit 1

P0.2 (O) CG encode bit 2/Volume attenuator bit 2

P0.3 (O) CG encode bit 3/Voice mute

P0.4 (I) Low Battery indication (active low)/ANI Alert

P0.5 (O) Transmit CG Switch (active high)

P0.6 (O) Mute (active low)

P0.7 (O) Delayed PTT (active low)

P1.0 (O) Fast SQ

P1.1 (I) Load (serial load)

P1.2 (I) Clock (serial load)

P1.3 (I) CAS (active low)

P1.4 (I) QH (active low) (serial load)

P1.5 (O) Xtal bit

P1.6 (O) Mic mute (active low)

P1.7 (O) Power select

P2.0 (O) LCD enable

P2.1 (O) LCD data

P2.2 (O) LCD clock

P2.3 (O) Receive mute (active high)

P2.4 (O) T99/ANI

P2.5 (O) Synthesizer clock

P2.6 (O) Synthesizer enable

P2.7 (O) Synthesizer data

RXD (I) Programmer data

TXD (I/O) Programmer data out/PTT

P3.2 (I) Tone data

P3.3 (I) Lock detect (active high)

P3.4 (O) Alert tone

P3.5 (O) Band switch

P3.6 (O) E^2PROM clock

P3.7 (O) E^2PROM data

EEPROM

The 512 X 8 - bit **EEPROM** (U701), commonly referred to as the personality **PROM**, stores customer information as follows:

- Customer frequencies
- Customer tones
- Customer options

Using the **EEPROM** provides the convenience of programming without opening the radio.

Programming of the **EEPROM** is accomplished by driving the **MIC HI** lead which is connected to operational amplifier circuit U302.2. With no external signal connected to **MIC HI**, a voltage level of 2.1 volts is at **MIC HI**. This causes the output of U302.2 (the program data line) to be high.

When the **MIC HI** is pulled low, the program data line is pulled low. If this line remains low for 20 milliseconds or greater, the microprocessor is switched into the programming mode. Once in this mode, the radio will not operate or respond to any front case button. The radio must be turned off and then back on to get the processor out of this mode.

When the microprocessor is programmed, the processor will be taken out of the programming mode by the proper character from the personal computer programmer.

Rx Audio Processing

Voice Path: Received audio enters the Audio/Logic Board on Pin 10 of J801. Frequencies below 300 Hz are attenuated by the Channel Guard reject filter consisting of U602.1 and associated circuitry.

The output from the CG reject filter is coupled through voice mute switch transistor Q603 to the volume attenuator circuit U602.2, and resistors R632 through R640. The feedback resistors are selected by bilateral switch Q603 and controlled by inputs volume bit 0, 1, and 2. Here the 500 Hz Alert tone, generated by the microprocessor, can be added to the received audio at the alert tone input.

The volume attenuator has a range of 48 dB. The attenuator output is coupled through **RX MUTE** switching transistor Q606 to audio amplifier transistor U604. ANI alert is coupled to U604 input through C608 and R673. Power is supplied to the audio amplifier by transistors Q605 and Q606 and controlled by the **MUTE** line from the microprocessor. Amplifier U604 drives the speaker with differential outputs, which are also connected to the accessory connector through the Control Assembly.

A 6 dB/octave de-emphasis is provided by capacitor C615 and resistor R628 in the CG reject filter. Capacitor C622 and resistor R644 provide additional roll-off at higher frequencies.

Squelch Path: The squelch circuit operates on the noise components contained in the discriminator output. The signal at J801-10 is applied to a high-pass filter consisting of U601.2 and associated circuitry. The output of U601.2 is noise in a band around 6 kHz. The gain of the high-pass filter is determined by squelch potentiometer R608.

The output of U601.2 is rectified by U601.1, resistors R610 through R612, and capacitors C607 and C639. C607 is switched into operation by Q609. The Fast Squelch line in turn controls Q609. C607 is always switched into operation during non scan operation. During scan operation, C607 is switched out of the circuit for rapid squelch operation. This DC signal is then applied to comparator U601.4. If the rectified noise is more than 0.20 Vdc, the **CAS** line is high and the microprocessor mutes the audio. Feedback resistor at U601.4 provides about 2 dB of hysteresis. Resistors R614, R662, R663 and thermistor R664 are used for temperature compensation or the threshold level.

The threshold level is temperature compensated at cold temperatures only by thermistor R664. This is necessary because of a drop in the **VOL/SQ. HI** noise level. Thermistor R664 has a negative temperature coefficient. At 25°C and above, the thermistor has little effect on the threshold voltage level at U601B, Pin 12. At temperatures below 25°C, the resistance increases expotentially, thereby causing a drop in the threshold voltage. This voltage drop approximately tracks the voltage drop at the detected noise terminal, U601.2-13.

Limited Tone Data Path

Limited Tone Data is the 5 Volts (Peak-to-Peak) representation of a received tone and is fed to the microprocessor where the actual tone decoding occurs. This circuit consists of an amplifier followed by a low-pass filter for voice rejection and a voltage comparator.

The low-pass filter consists of U606.1 and associated circuitry. This filter is used for both Channel Guard encoding and decoding. The filter has a breakpoint at 210 Hz. Type 99 decoding is done by bypassing the low-pass filter and going directly to comparator U606.2.

TX Audio Processing

Audio from the microphone is applied to a 6 dB/octave pre-emphasis network consisting of capacitor C301 and resistor R306 and then to amplifier U301.1. Amplifier U301.2 provides further gain and symmetrical limiting. The output of U301.2 is coupled through mic mute switch U605.3 to the post-limiter filter consisting of U302.1 and associated circuitry. Transmit Channel Guard tones are added to the microphone audio at the post-limiter filter. GE Star ANI is also fed into the post limiter filter when programmed.

The transmit signal is applied to the low-frequency boost circuit U303.1, U303.2 and associated circuitry. The transmit deviation is set by MOD potentiometer R321.

The low frequency boost circuitry provides an increasing output level as the input frequency decreases below 20 Hz. The shape of the response curve is shown in Figure 4. This shape is intended to be the mirror image of the synthesizer frequency response curve. The combined result of these two curves provide relatively flat modulation below 5 Hz. This is necessary for Digital Channel Guard modulation.

Regulator and Special Circuitry

+ 5 Volt Regulator

A +5 regulator (U802) supplies power to the microprocessor and all other circuitry requiring +5 volts. A voltage divider provides the input to U601.3 to generate a 2.25 volt reference for operational amplifier biasing.

Low Voltage Reset

Voltage detector U801 and transistor Q803 provide the microprocessor with the necessary reset signal during the power up routine, and also reset the microprocessor when the battery falls below approximately 4.75 volts (see Figure 5).

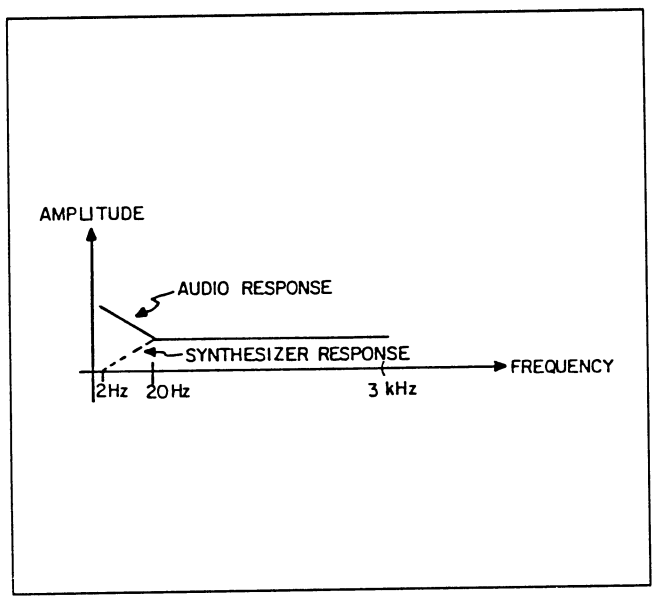

Figure 4 - Audio Response Curve

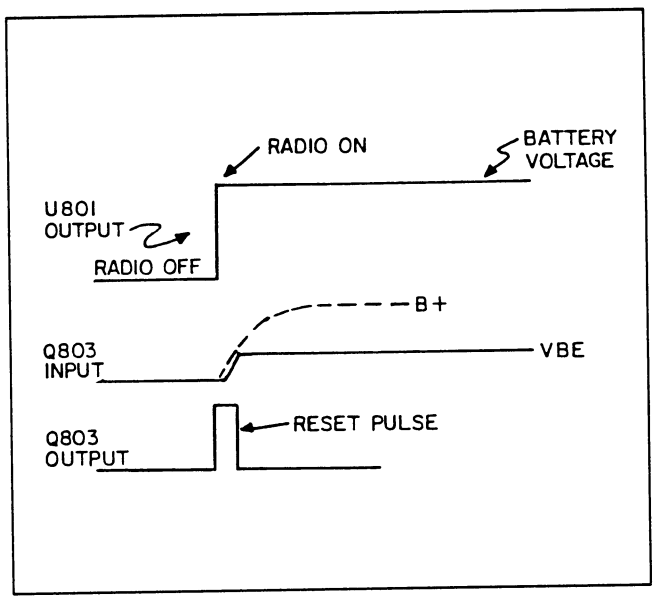

Figure 5 - Voltage Waveforms

Low Battery Indicator

When the battery voltage drops to approximately 6.3 volts, the **BAT IND** line from the RF board is sufficiently high to turn on transistor Q802. The output of Q802, the low battery line, drives a microprocessor port. This action turns on the **BAT** pixel on the LCD.

User Input

Control assembly connector J901 and Scan connector J802 on the Audio/Logic Board provide the interface between the operator and the radio. By pressing buttons on the switch panel or scan keypad, the operator can:

- Change volume level or channel
- Monitor a channel
- Key the transmitter
- Turn scan on or off
- Add or delete scan channels
- Switch to HOME channel

All operator commands are applied to an 8-bit shift register (U803), which loads the data and control inputs into the microprocessor through J701-3, J701-4, and J701-6.

The LCD is updated to reflect the current status of the radio. The microprocessor configures the LCD through **LCD EN** (P2.0), **LCD DAT** (P2.1) and **LCD CLK** (P2.2).

Synthesizer Programming

After a reset, when toggling between transmit and receive, and any time a new channel is selected, the microprocessor must reprogram the synthesizer through **SYN CLK** (P2.5), **SYN DAT** (P2.7) and **SYN EN** (P2.6). When locked, the **LOCK DET** line (J9801-11) is high.

Alert Tone

The microprocessor generates a 500 Hz alert tone (P3.4) used to signal the user of critical events. These events include synthesizer out of lock and activation of the volume up, volume down and channel up buttons. The alert tone can be disabled by the programmer.

Microprocessor Xtal Frequency Pull

Port P1.5 of the microprocessor is used to switch a 33 pf capacitor (C701) into the crystal oscillator circuit. The effect of adding this capacitor is to move or pull the xtal frequency approximately 250 ppm. This is done to keep harmonics of the microprocessor **ALE** line away from the receive channel frequency.

The programming at this point happens automatically when channel frequencies are initially programmed.

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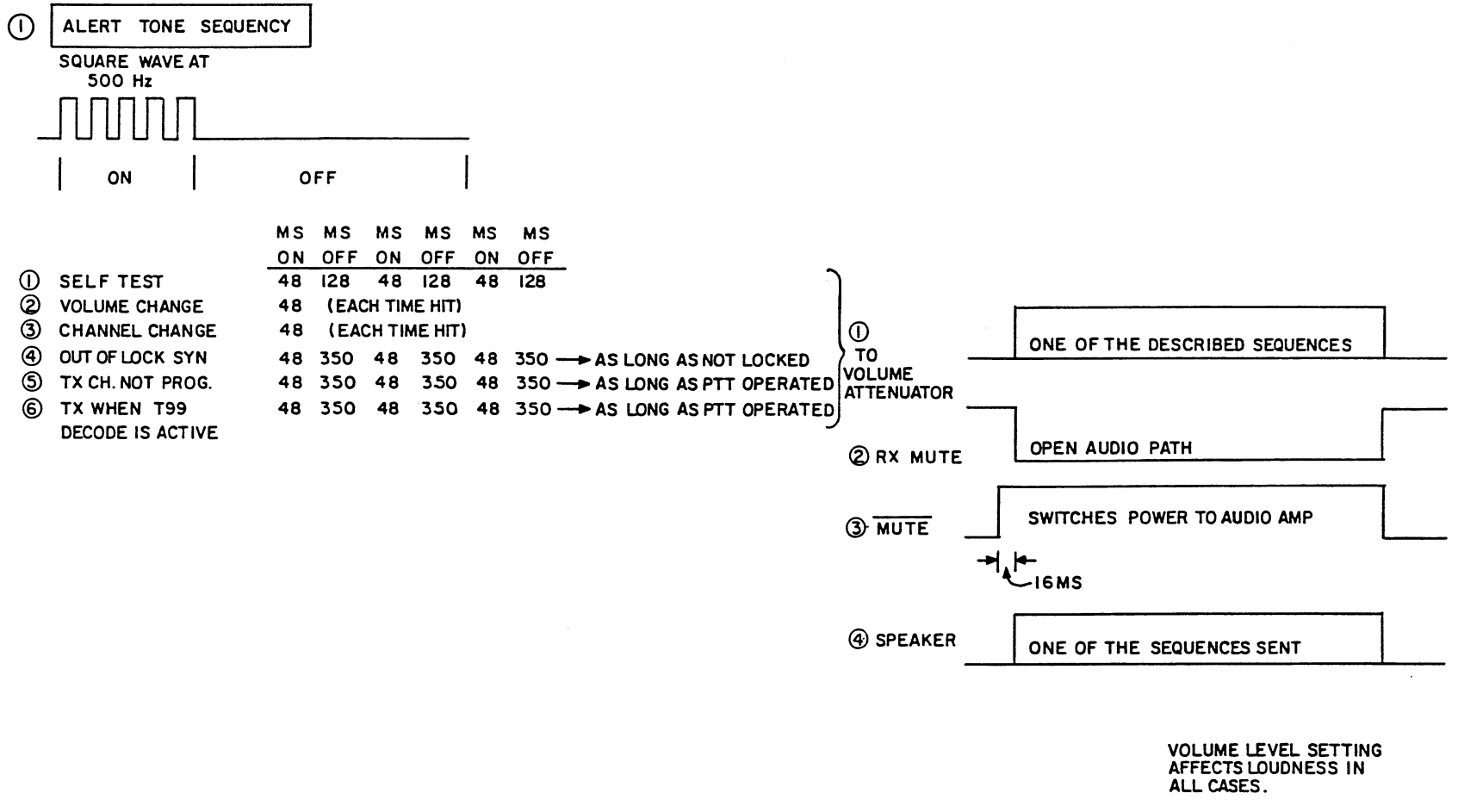


Figure 6 - Alert Tone Sequences

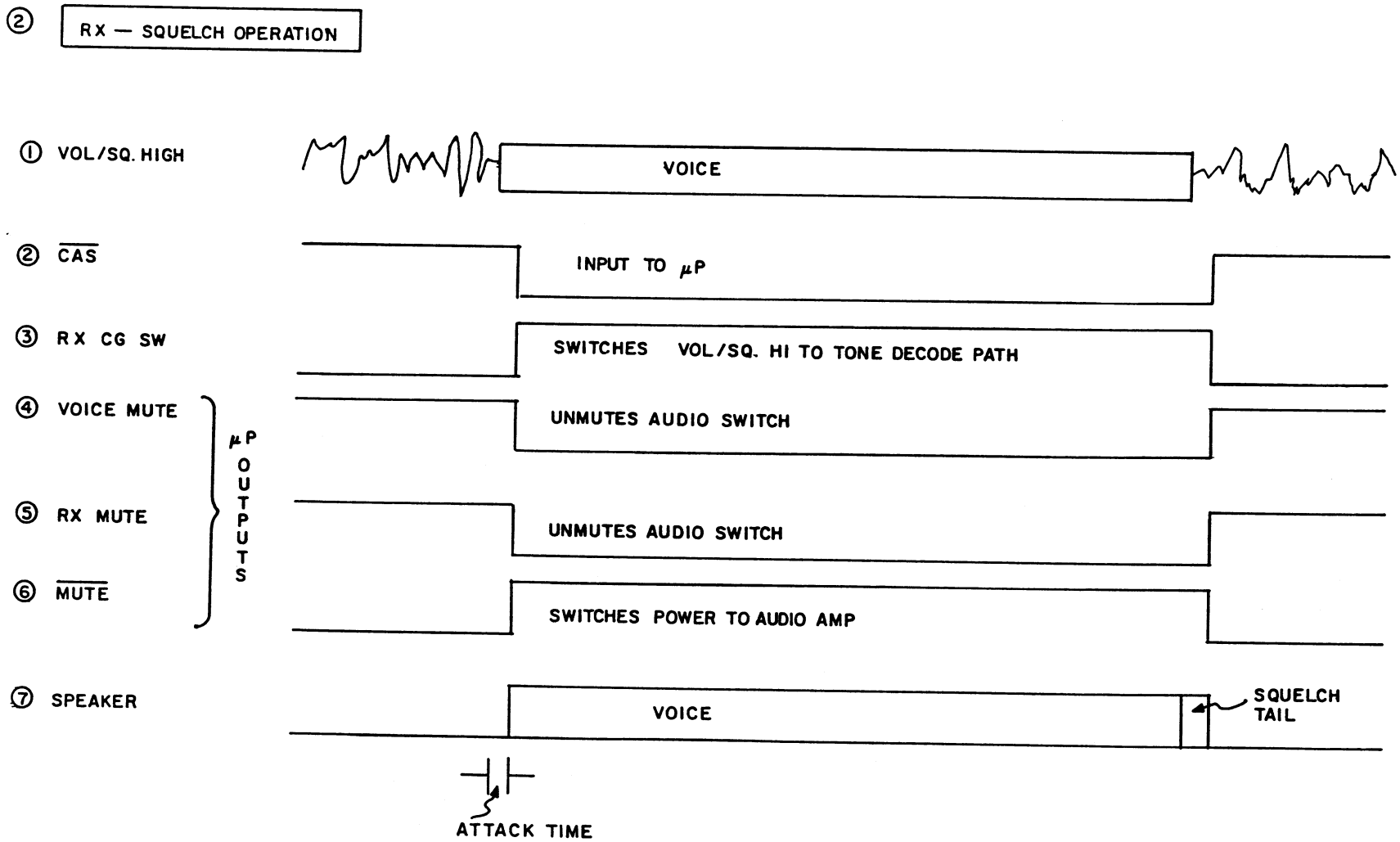


Figure 7 - RX Squelch Operation

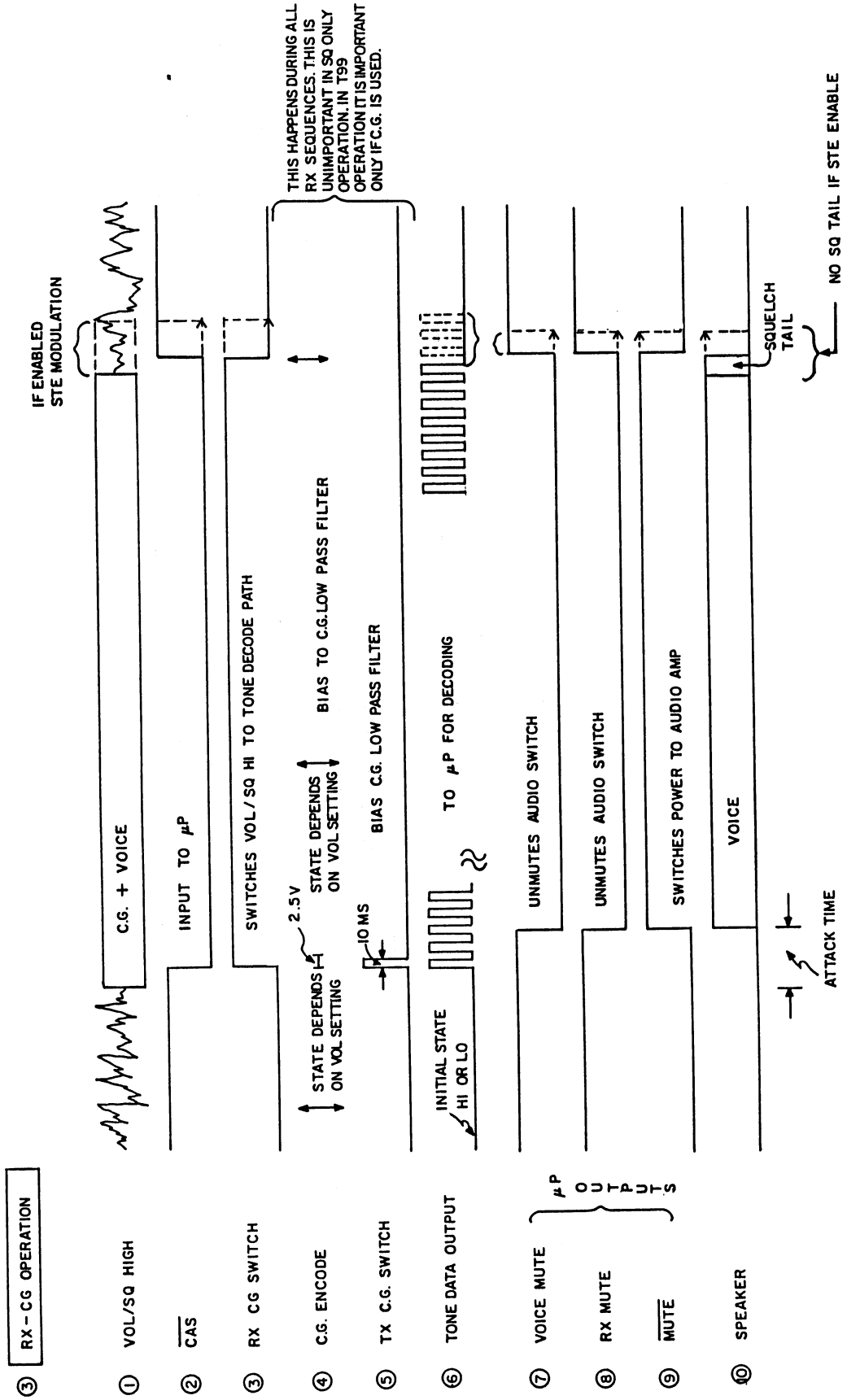


Figure 8 - RX Channel Guard Operation

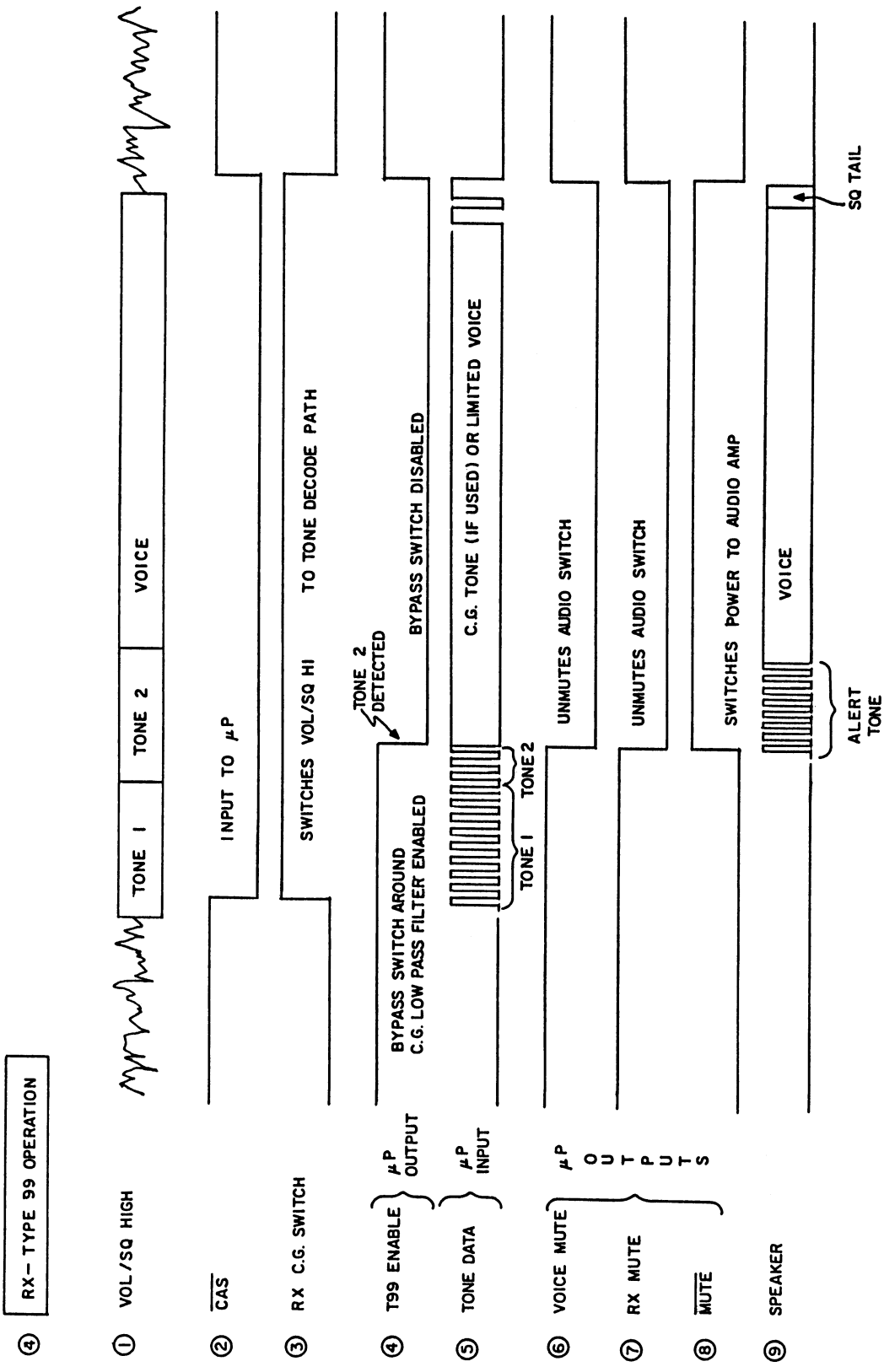


Figure 9 - RX Type 99 Operation

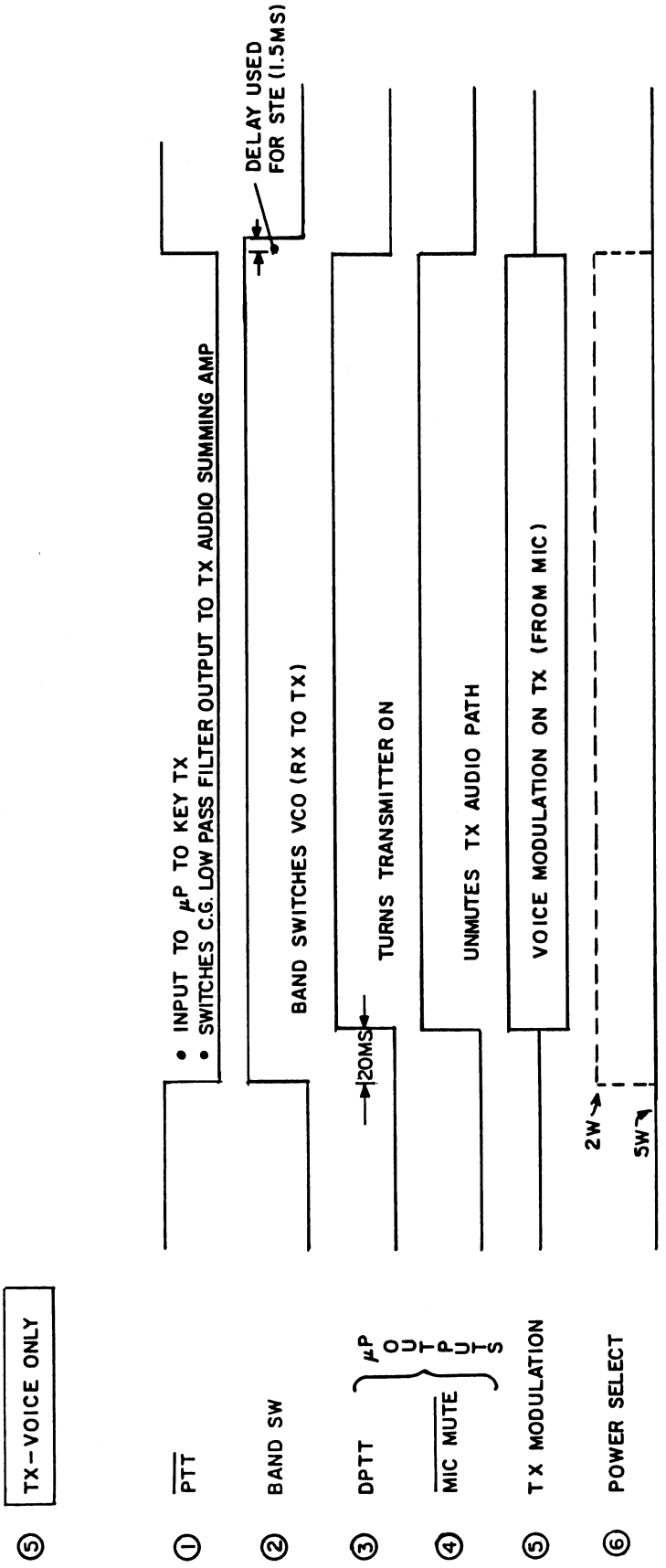


Figure 10 - TX Voice Only Operation

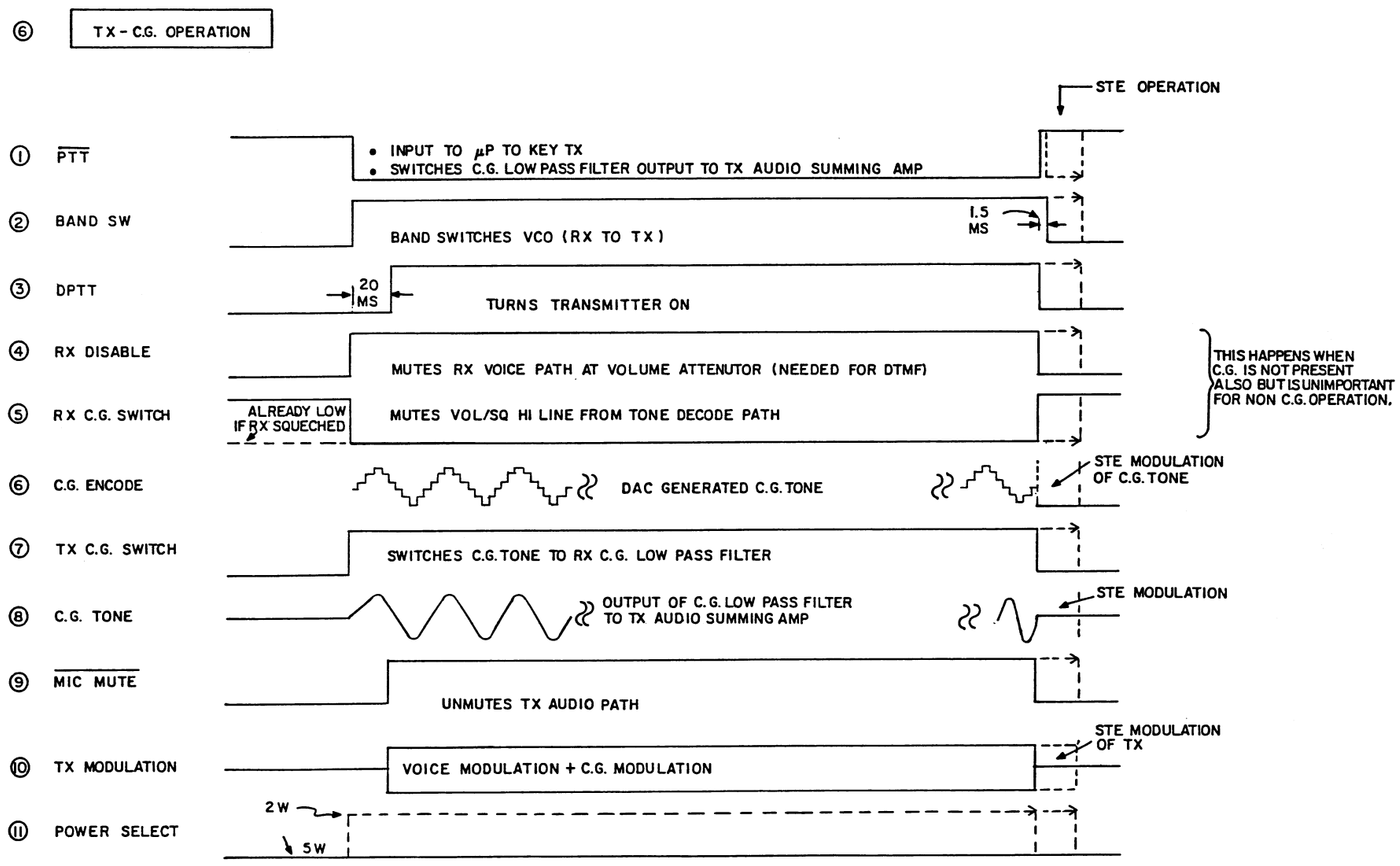
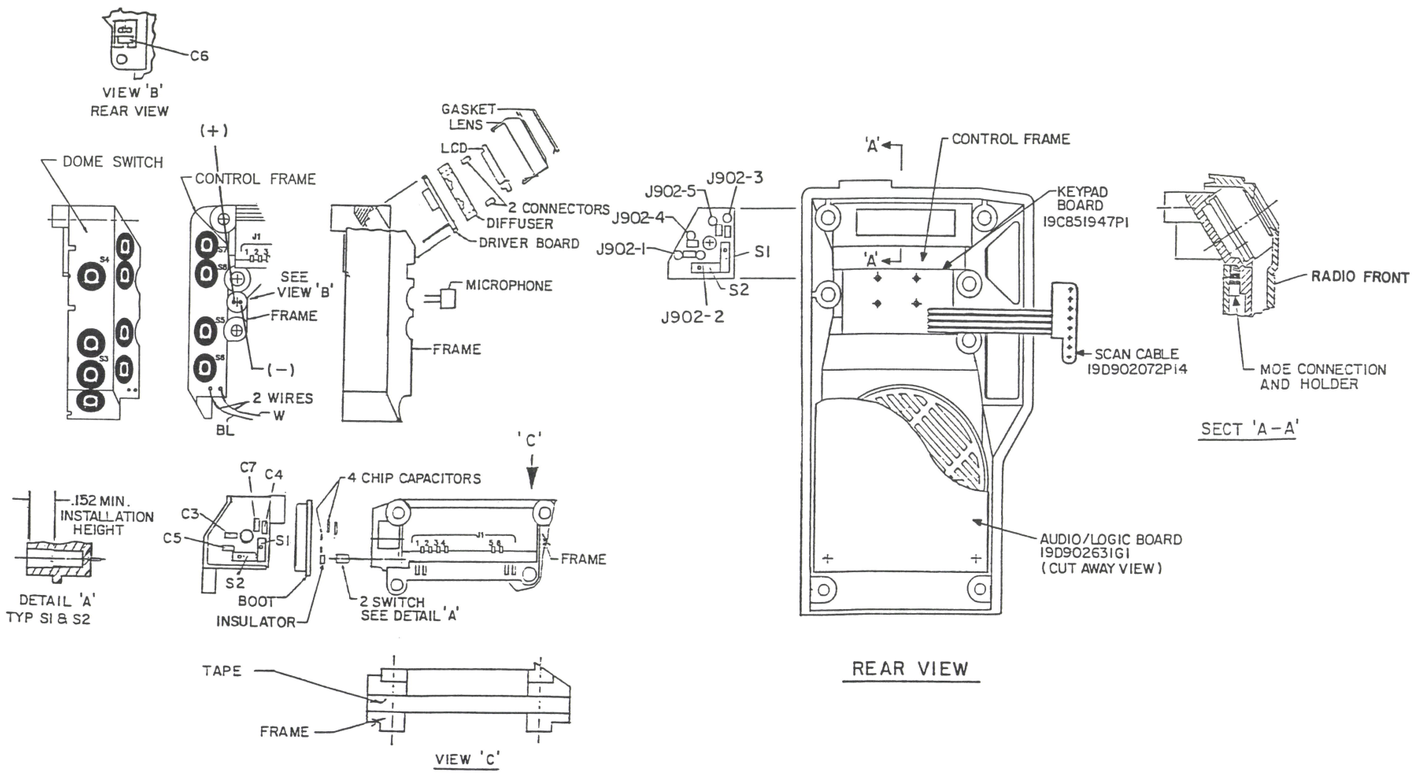
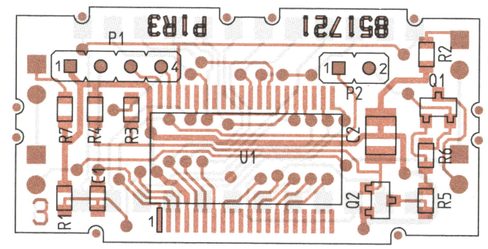


Figure 11 - TX Channel Guard Operation



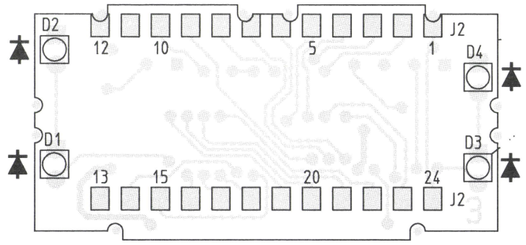
FRONT CAP ASSEMBLY
19D902180G1

COMPONENT SIDE



(19C851720, Sh. 1, Rev. 3)
(19C851721, Component Side, Rev. 3)
(19C851721, Solder Side, Rev. 3)

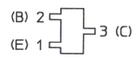
SOLDER SIDE

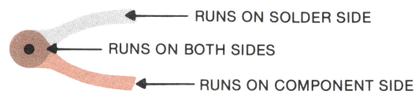


BACK VIEW OF BOARD

(19C851720, Sh. 1, Rev. 3)
(19C851721, Solder Side, Rev. 3)

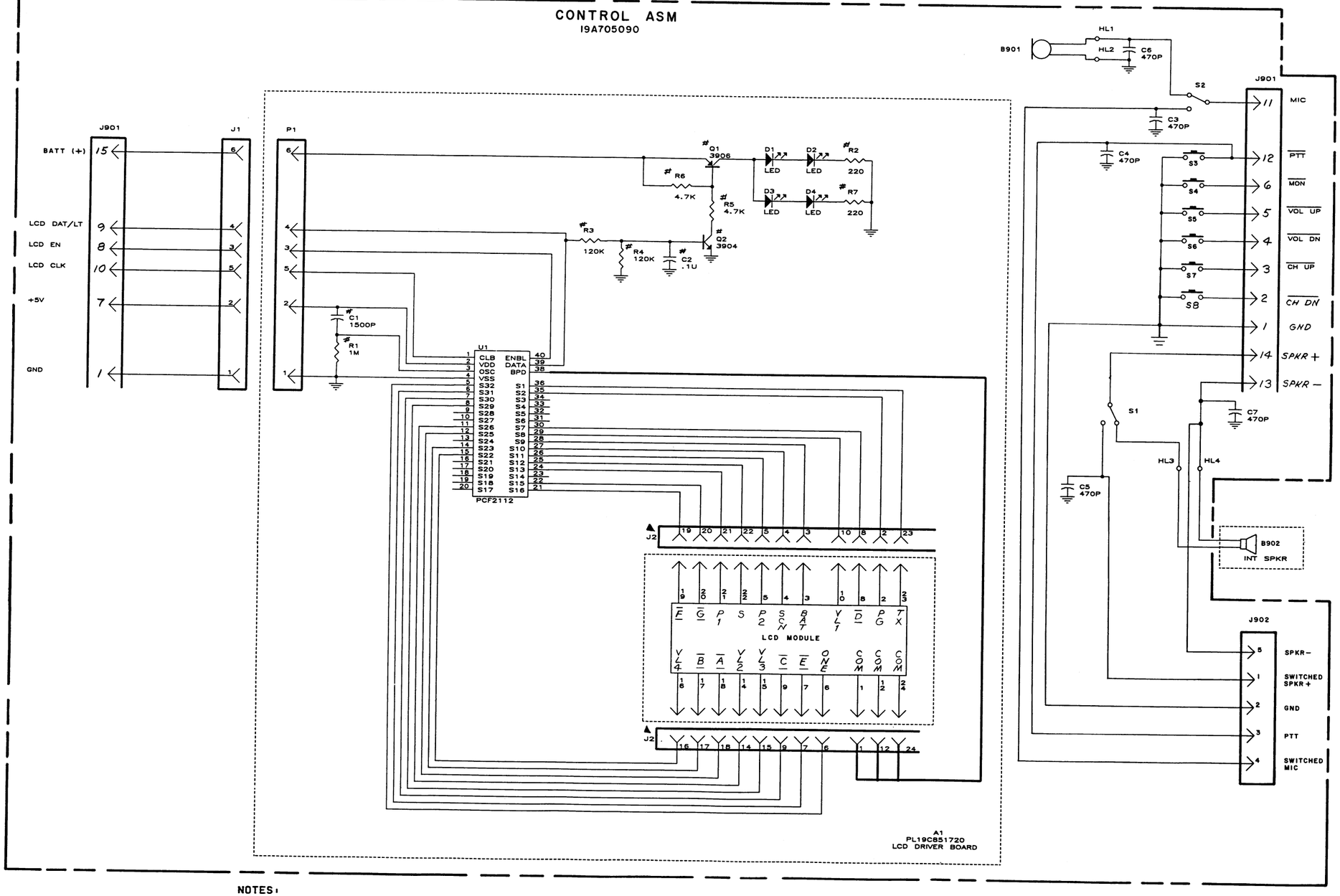
LEAD IDENTIFICATION FOR
Q1, & Q2
(SOT) TRANSISTORS
(TOP VIEW)





LCD BOARD
19C851720G1

CONTROL ASM
19A705090



NOTES:
1. ALL RESISTORS ARE .1 WATT UNLESS OTHERWISE SPECIFIED.
   RESISTOR VALUES IN Ω UNLESS FOLLOWED BY MULTIPLIER K OR M.
   CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U,N OR P.
   INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M OR U.

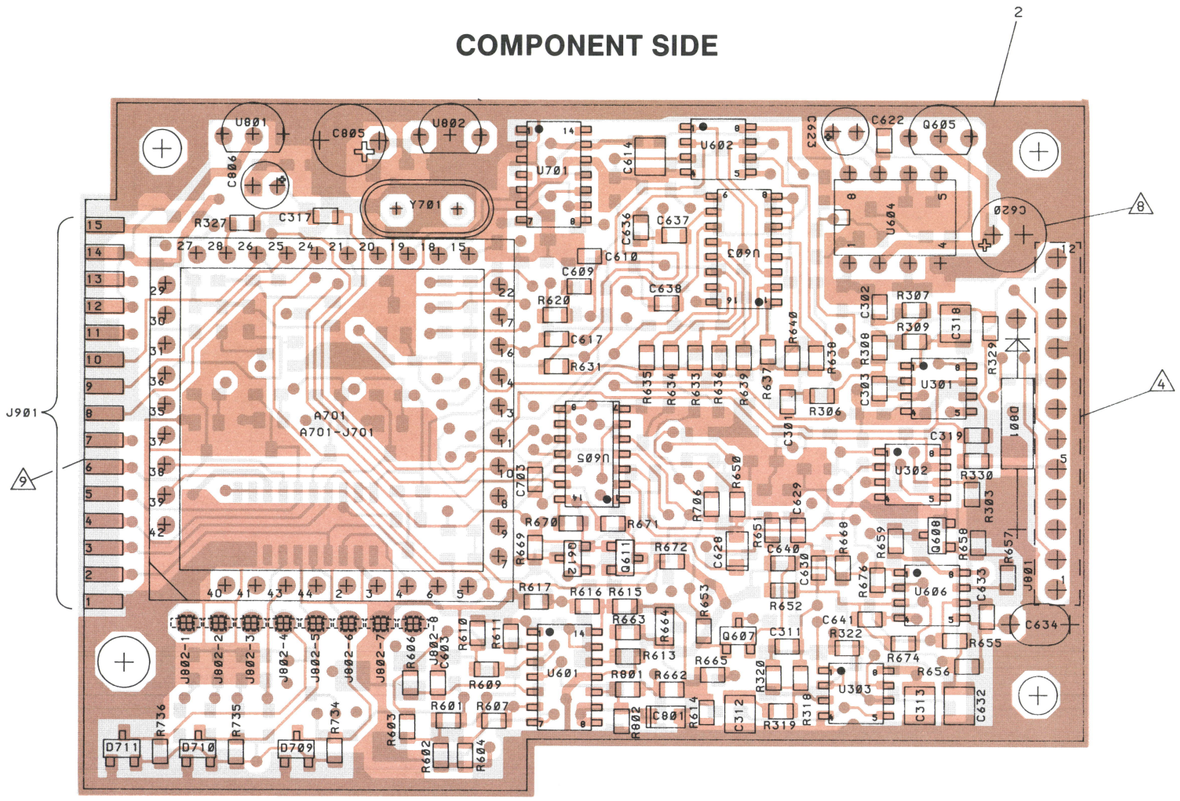
2. # INDICATES CHIP COMPONENTS.

3. ▲ PART OF PWB.

FRONT CAP ASSEMBLY
19D902180G1

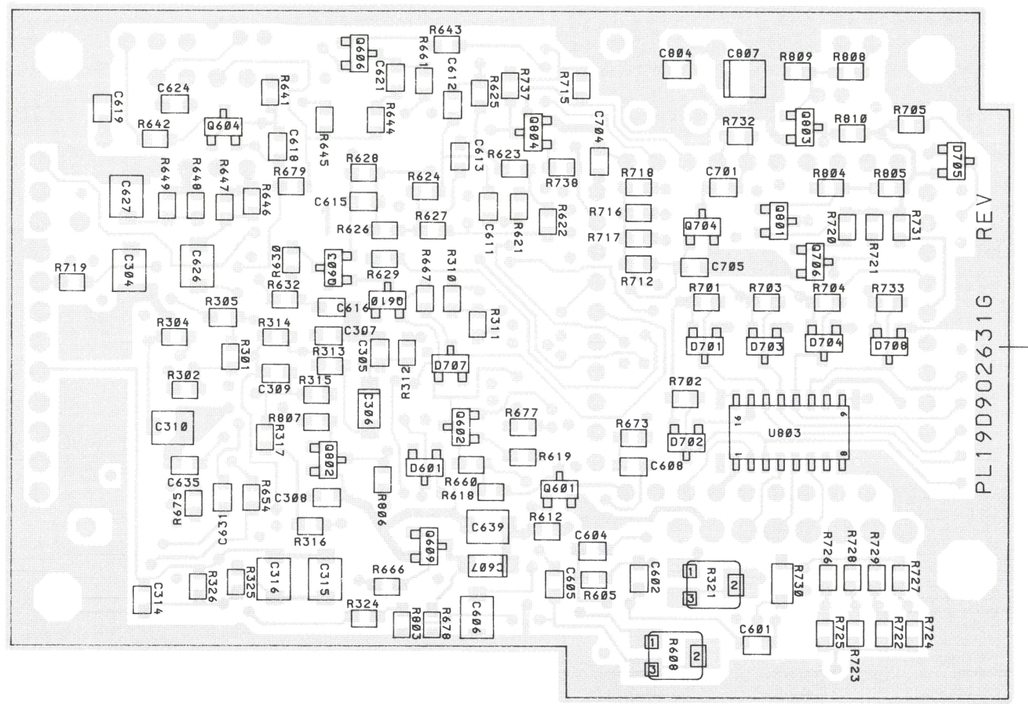
(19D902216, Sh. 2 Rev. 3)

COMPONENT SIDE



(19C851678, Sh. 1, Rev. 1)
(19C851679, Component Side, Rev. 3)
(19C851679, Solder Side, Rev. 3)

SOLDER SIDE

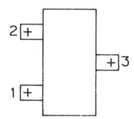


BACKVIEW OF BOARD

(19C851678, Sh. 1, Rev. 1)
(19C851679, Solder Side, Rev. 3)

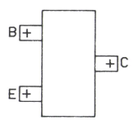
LEAD IDENTIFICATION FOR
D601 & D701-D711
(SOT) DIODES

(TOP VIEW)



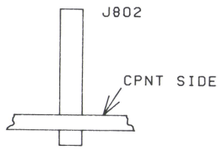
LEAD IDENTIFICATION FOR
Q601-Q612,Q704,Q706,Q801-Q804
(SOT) TRANSISTORS

(TOP VIEW)



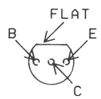
AUDIO/LOGIC BOARD
19D902631G1

3



CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

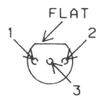
LEAD IDENTIFICATION FOR Q605



IN-LINE
TOP VIEW

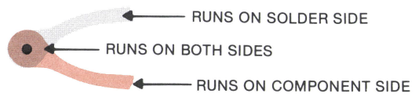
NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

LEAD IDENTIFICATION FOR U802

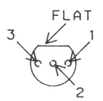


IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.



LEAD IDENTIFICATION FOR U801

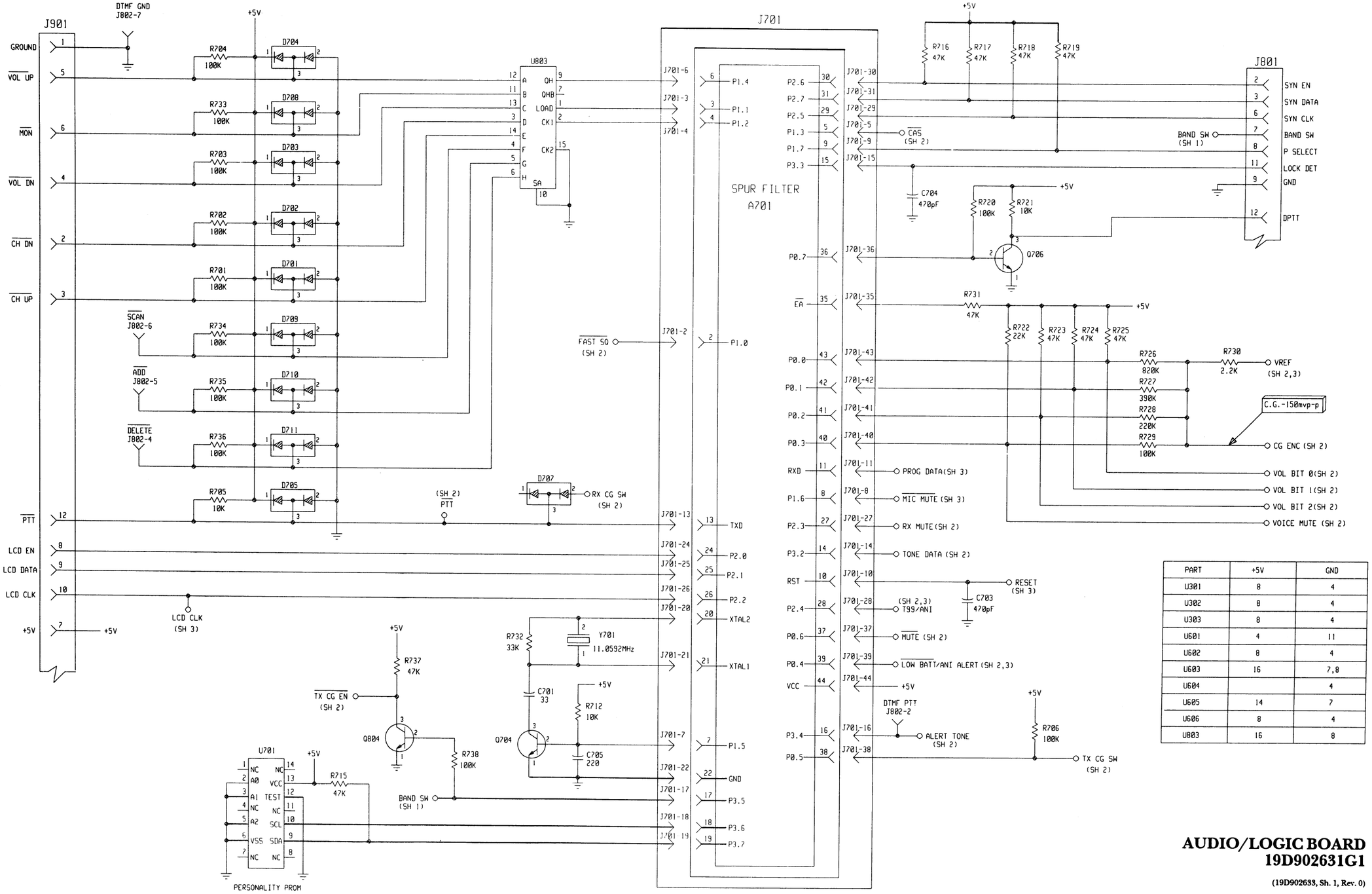


IN-LINE
TOP VIEW

NOTE: CASE SHAPE IS DETERMINING FACTOR FOR LEAD IDENTIFICATION.

(1)

NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. COMPONENT LEADS TO PROTRUDE .06 MAX. BELOW SOLDER SIDE OF BOARD.
3. INDICATES FRONT OF COMPONENT AUTO-INSERTION MACHINES.
4. ASSEMBLE BAR CODE ON SIDE OF J801 CONNECTOR.
5. THE FOLLOWING ITEMS ARE MOS DEVICES REQUIRING SPECIAL CARE PER 19A701294: U301-U303, U601-U606, U701, U803 & A701.
6. MARK GR.NO. & REV.LTR. PER 19A700154P1. FOR LATEST REV. LETTER SEE 19C851716.
7. MAX HEIGHT OF ALL COMPONENTS ON BD. IS .41.
8. C620 MUST BE MOUNTED FLUSH TO .005 TO THE PRINTED BOARD.
9. GOLD CONTACT FINGERS ARE TO BE KEPT FREE OF ANY FOREIGN SUBSTANCE.

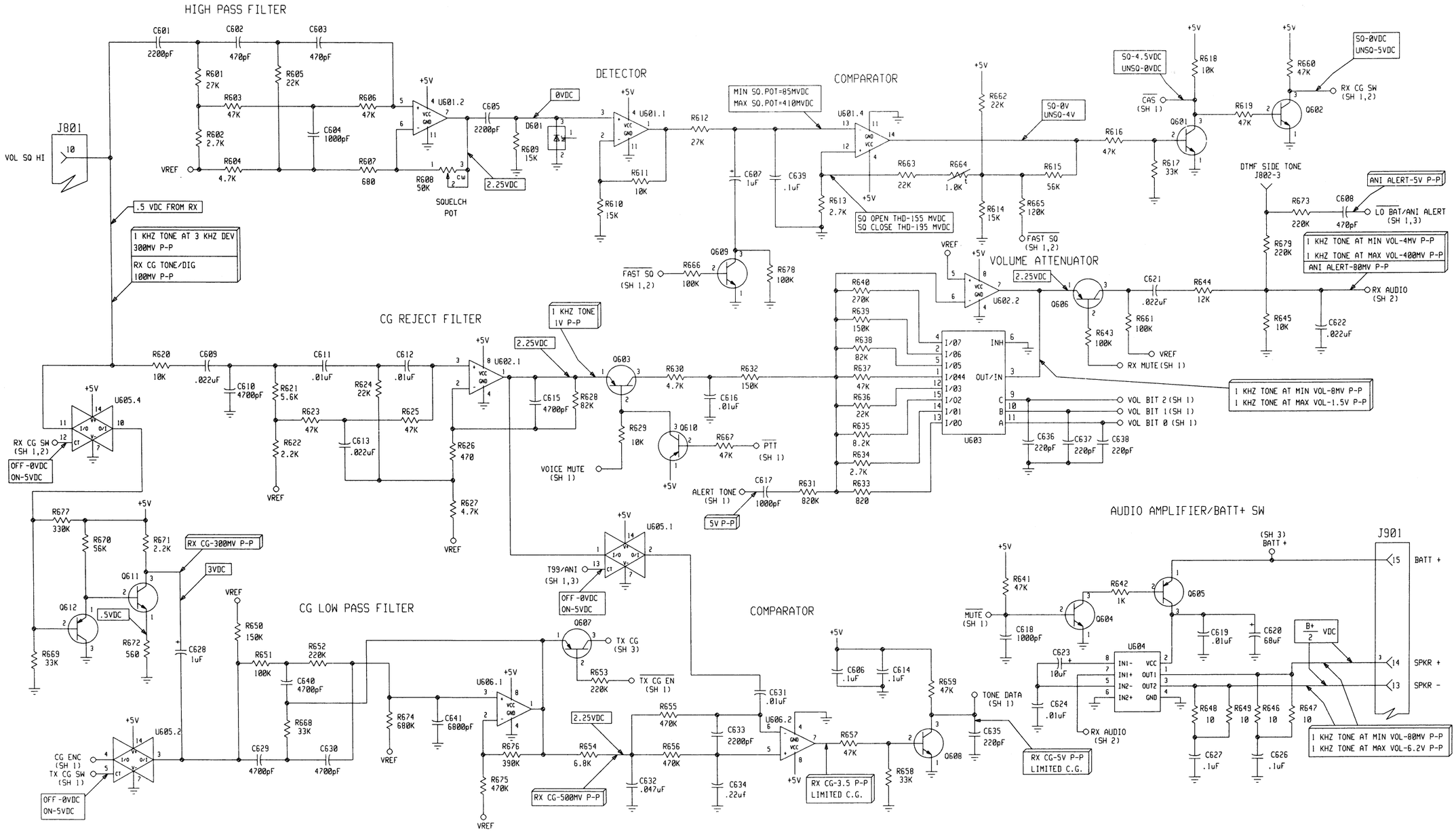


PART	+5V	GND
U301	8	4
U302	8	4
U303	8	4
U601	4	11
U602	8	4
U603	16	7,8
U604		4
U605	14	7
U606	8	4
U803	16	8

AUDIO/LOGIC BOARD 19D902631G1

(19D902633, Sh. 1, Rev. 0)

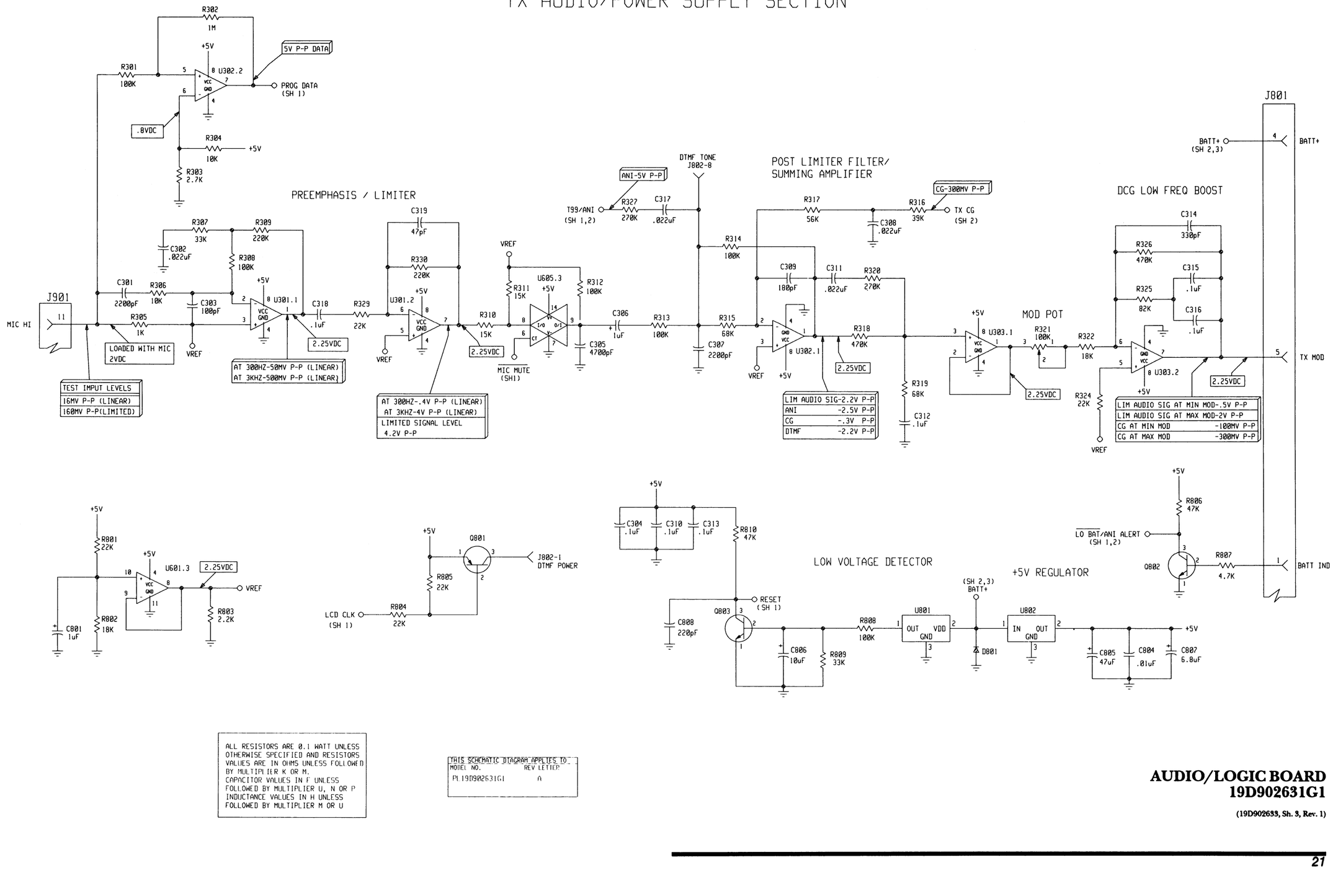
RX AUDIO SECTION



AUDIO/LOGIC BOARD
19D902631G1

(19D902633, Sh. 2, Rev. 0)

TX AUDIO/POWER SUPPLY SECTION



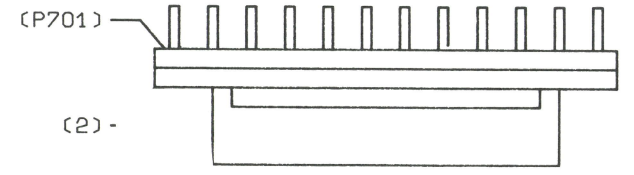
ALL RESISTORS ARE 0.1 WATT UNLESS OTHERWISE SPECIFIED AND RESISTORS VALUES ARE IN OHMS UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U, N OR P
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M OR U

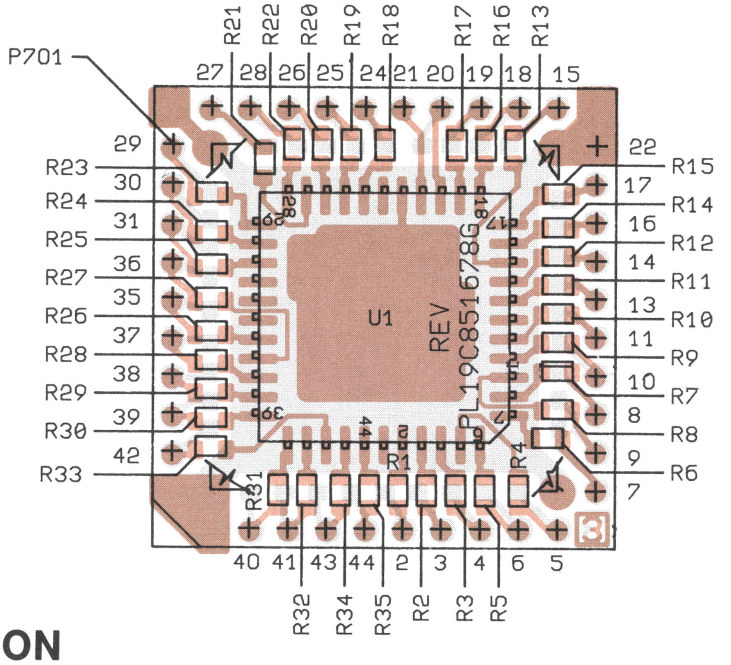
THIS SCHEMATIC DIAGRAM APPLIES TO	
MODEL NO.	REV LETTER
PLI9D902631G1	A

AUDIO/LOGIC BOARD 19D902631G1

(19D902633, Sh. 3, Rev. 1)

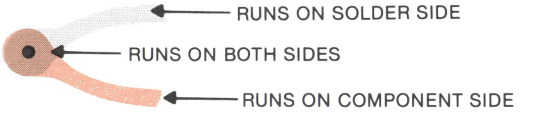
COMPONENT SIDE



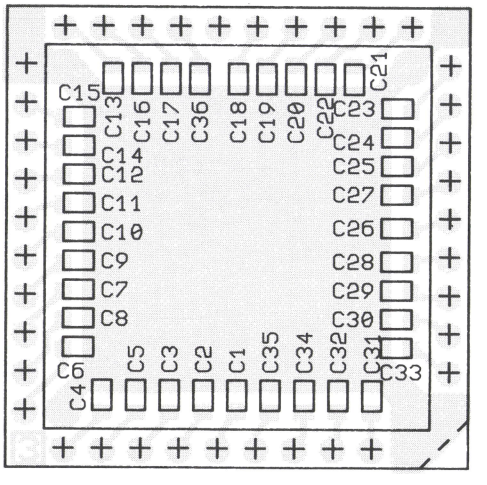


CAUTION
OBSERVE PRECAUTIONS FOR HANDLING
ELECTROSTATIC SENSITIVE DEVICES

(19D902631, Sh. 1, Rev. 0)
(19D902632, Layer 1, Rev. 1)
(19D902632, Layer 4, Rev. 1)



SOLDER SIDE

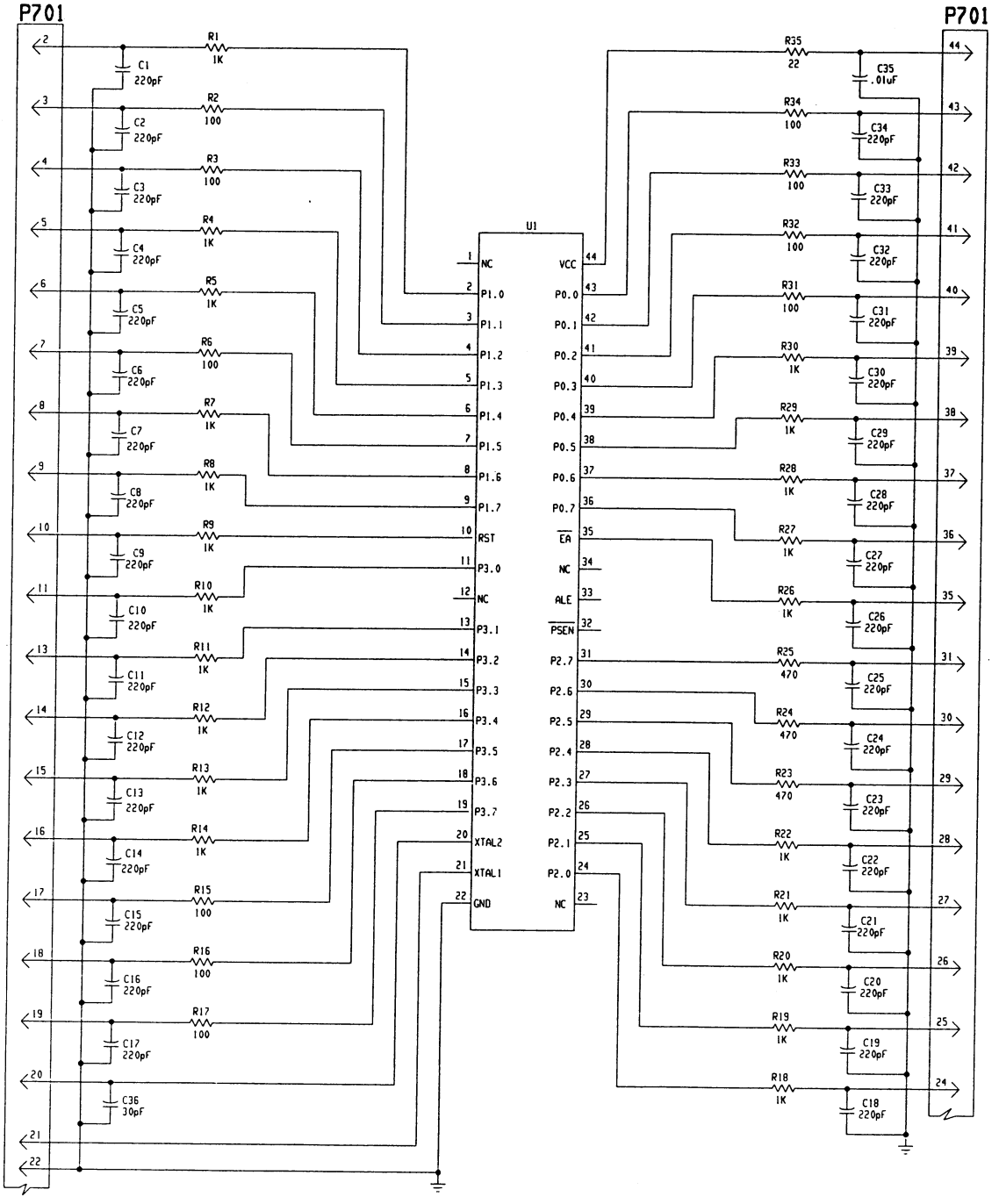


VIEW FROM SOLDER SIDE

(19D902631, Sh. 1, Rev. 0)
(19D902632, Layer 4, Rev. 1)

MICROPROCESSOR BOARD
19C851678G3

G1



ALL RESISTORS ARE 0.1 WATT UNLESS OTHERWISE SPECIFIED AND RESISTORS VALUES ARE IN OHMS UNLESS FOLLOWED BY MULTIPLIER K OR M.
CAPACITOR VALUES IN F UNLESS FOLLOWED BY MULTIPLIER U, N OR P
INDUCTANCE VALUES IN H UNLESS FOLLOWED BY MULTIPLIER M OR U

THIS SCHEMATIC DIAGRAM APPLIES TO

MODEL NO.	REV LETTER
19C851678G1	C
19C851678G2	C
19C851678G3	B

MICROPROCESSOR BOARD 19C851678G3

(19D902215, Sh. 1, Rev. 6)

RADIO FRONT ASSEMBLY (SCAN)
19D902177G7
ISSUE 2

SYMBOL	PART NO.	DESCRIPTION
A2		AUDIO/LOGIC BOARD 19D902631G1
A701		SPUR FILTER BOARD 19C851678G3
		---------- CAPACITORS ----------
C1 thru C34	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C.
C35	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C36	19A702061P35	Ceramic: 30 pF ±5%, 50 VDCW, temp coef 0 30 PPM.
		---------- PLUGS ----------
P701	19B801573P1	Connector.
		---------- RESISTORS ----------
R1	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R2 and R3	19B801251P101	Metal film: 100 ohms ±5%, 1/10 w.
R4 and R5	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R6	19B801251P101	Metal film: 100 ohms ±5%, 1/10 w.
R7 thru R14	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R15 thru R17	19B801251P101	Metal film: 100 ohms ±5%, 1/10 w.
R18 thru R22	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R23 thru R25	19B801251P471	Metal film: 470 ohms ±5%, 1/10 w.
R26 thru R30	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R31 thru R34	19B801251P101	Metal film: 100 ohms ±5%, 1/10 w.
R35	19B801251P220	Metal film: 22 ohms ±5%, 1/10 w.
		-------- INTEGRATED CIRCUITS -------
U1	19A705557P7	Microcomputer: 8-bit, 44-pin, sim to INTEL N80C52.
		---------- CAPACITORS ----------
C304	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C305	19A702052P10	Ceramic: 4700 pF ±10%, 50 VDCW.
C306	19A705205P2	Ceramic: 1 µF ±20%, 16 VDCW; sim to Sprague 293D.
C307	19A702052P107	Ceramic: 2200 pF ±5%, 50 VDCW.
C308	19A702052P30	Ceramic: 0.022 µF ±10%, 50 VDCW.
C309	19A702061P67	Ceramic: 180 pF ±5%, 50 VDCW, temp coef 0 30 PPM.
C310	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C314	19A702061P73	Ceramic: 330 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C.
C315 and C316	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C601	19A702052P107	Ceramic: 2200 pF ±5%, 50 VDCW.
C602	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 30 PPM.
C604	19A702052P105	Ceramic: 1000 pF ±5%, 50 VDCW.
C605	19A702052P7	Ceramic: 2200 pF ±10%, 50 VDCW.
C606	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C607	19A705205P2	Ceramic: 1 µF ±20%, 16 VDCW; sim to Sprague 293D.
C608	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 30 PPM.
C611 and C612	19A702052P114	Ceramic: 0.01 µF ±5%, 50 VDCW.
C613	19A702052P30	Ceramic: 0.022 µF ±10%, 50 VDCW.
C615	19A702052P10	Ceramic: 4700 pF ±10%, 50 VDCW.
C616	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C618	19A702052P5	Ceramic: 1000 pF ±10%, 50 VDCW.
C619	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C620	19A704879P14	Electrolytic: 68 µF ±20%, 10 VDCW.
C621	19A702052P30	Ceramic: 0.022 µF ±10%, 50 VDCW.
C623	19A704879P5	Electrolytic: 10 µF ±20%, 16 VDCW.
C624	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C626 and C627	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C631	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C634	19A143565P12	Ceramic: 0.22 µF ±10%, 50 VDCW.
C635	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C.
C639	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
C701	19A702061P37	Ceramic: 33 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C.
C704	19A702061P77	Ceramic: 470 pF ±5%, 50 VDCW, temp coef 0 30 PPM.
C705	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C.
C804	19A702052P14	Ceramic: 0.01 µF ±10%, 50 VDCW.
C805	19A701534P9	Tantalum: 47 µF ±20%, 6.3 VDCW.
C806	19A704879P5	Electrolytic: 10 µF ±20%, 16 VDCW.
C807	19A705205P14	Tantalum: 6.8 µF, 6 VDCW; sim to Sprague 293D.
C808	19A702061P69	Ceramic: 220 pF ±5%, 50 VDCW, temp coef 0 30 PPM/°C.
		---------- DIODES ----------
D601	19A705377P3	Silicon, Hot Carrier: sim to HSMS-2920.
D701 thru D705	19A700053P2	Silicon: 2 Diodes in Series; sim to BAV99.
D707 and D708	19A700053P2	Silicon: 2 Diodes in Series; sim to BAV99.
D801	19A116585P1	Silicon, fast recovery, 600 mA, 50 PIV.
		---------- JACKS ----------
J701		Part of printed wire board 19D902631P1.
J801	19A705482P1	Connector, printed wire.
J802	19B209648P1	Contact, electrical.
J901		Part of printed wire board.
		---------- TRANSISTORS ----------
Q601 and Q602	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q603	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q604	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q605	19A700026P2	Silicon, PNP: sim to BC369.
Q606	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.

*COMPONENTS ADDED, DELETED ORCHANGED BY PRODUCTION CHANGES

SYMBOL	PART NO.	DESCRIPTION
Q609	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q610	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q704	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q706	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
Q801	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q802 thru Q804	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
		---------- RESISTORS ----------
R301	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R302	19B801251P105	Metal film: 1M ohms ±5%, 1/10 w.
R304	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R305	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R310 and R311	19B801251P153	Metal film: 15K ohms ±5%, 1/10 w.
R312 thru R314	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R315	19B801251P683	Metal film: 68K ohms ±5%, 1/10 w.
R316	19B801251P393	Metal film: 39K ohms ±5%, 1/10 w.
R317	19B801251P563	Metal film: 56K ohms ±5%, 1/10 w.
R321	19A705496P7	Variable resistor.
R324	19B801251P223	Metal film: 22K ohms ±5%, 1/10 w.
R325	19B801251P823	Metal film: 82K ohms ±5%, 1/10 w.
R326	19B801251P474	Metal film: 470K ohms ±5%, 1/10 w.
R605	19B801251P223	Metal film: 22K ohms ±5%, 1/10 w.
R608	19A705496P6	Variable resistor.
R612	19B801251P273	Metal film: 27K ohms ±5%, 1/10 w.
R618	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R619	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R621	19B801251P562	Metal film: 5.6K ohms ±5%, 1/10 w.
R622	19B801251P222	Metal film: 2.2K ohms ±5%, 1/10 w.
R623	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R624	19B801251P223	Metal film: 22K ohms ±5%, 1/10 w.
R625	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R626	19B801251P471	Metal film: 470 ohms ±5%, 1/10 w.
R627	19B801251P472	Metal film: 4.7K ohms ±5%, 1/10 w.
R628	19B801251P823	Metal film: 82K ohms ±5%, 1/10 w.
R629	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R630	19B801251P472	Metal film: 4.7K ohms ±5%, 1/10 w.
R632	19B801251P154	Metal film: 150K ohms ±5%, 1/10 w.
R641	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R642	19B801251P102	Metal film: 1K ohms ±5%, 1/10 w.
R643	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R644	19B801251P123	Metal film: 12K ohms ±5%, 1/10 w.
R645	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R646 thru R649	19B801251P100	Metal film: 10 ohms ±5%, 1/10 w.
R654	19B801251P682	Metal film: 6.8K ohms ±5%, 1/10 w.
R660	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R661	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R666	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R667	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R673	19B801251P224	Metal film: 220K ohms ±5%, 1/10 w.
R675	19B801251P474	Metal film: 470K ohms ±5%, 1/10 w.
R677	19B801251P334	Metal film: 330K ohms ±5%, 1/10 w.
R678	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R679	19B801251P224	Metal film: 220K ohms ±5%, 1/10 w.
R701 thru R704	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R705	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R712	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.

SYMBOL	PART NO.	DESCRIPTION
R715 thru R719	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R720	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R721	19B801251P103	Metal film: 10K ohms ±5%, 1/10 w.
R722	19B801251P223	Metal film: 22K ohms ±5%, 1/10 w.
R723 thru R725	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R726	19B801251P824	Metal film: 820K ohms ±5%, 1/10 w.
R727	19B801251P394	Metal film: 390K ohms ±5%, 1/10 w.
R728	19B801251P224	Metal film: 220K ohms ±5%, 1/10 w.
R729	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R730	19A702931P234	Metal film: 2210 ohms ±1%, 200 VDCW, 1/8 w.
R731	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R732	19B801251P333	Metal film: 33K ohms ±5%, 1/10 w.
R733	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R737	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R738	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R803	19B801251P222	Metal film: 2.2K ohms ±5%, 1/10 w.
R804 and R805	19B801251P223	Metal film: 22K ohms ±5%, 1/10 w.
R806	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
R807	19B801251P472	Metal film: 4.7K ohms ±5%, 1/10 w.
R808	19B801251P104	Metal film: 100K ohms ±5%, 1/10 w.
R809	19B801251P333	Metal film: 33K ohms ±5%, 1/10 w.
R810	19B801251P473	Metal film: 47K ohms ±5%, 1/10 w.
		-------- INTEGRATED CIRCUITS -------
U604	19A705452P1	Linear: Audio Amplifier; sim to TDA 2822M.
U801	19A705454P1	Voltage Detector, sim to Seiko S 8054ALO.
U802	19A702536P1	Linear positive voltage regulator; sim to LM2931AZ-5.
U803	19A703987P322	8-bit shift registor.
		---------- CRYSTALS ---------
Y701	19A702511G26	Quartz: 11.0592 MHz.
		--------- MISCELLANEOUS ---------
	19A702364P310	Machine screw, TORX Drive: No. M3-0.5 x 10.
	19B801570P2	Connector holder.
	19A705862P1	Connector, Elastomeric.
	19A702364P304	Machine screw.
A3		**FRONT CAP ASSEMBLY 19D902180G4**
		---------- MODULE ----------
B902	19A149673P1	Loudspeaker, round: Water Proof, 24 ohms, 1/2 w; sim to Line Electric Co. VS-50W24.
		--------- MISCELLANEOUS ---------
	19A702364P304	Machine screw.
	19C851997P1	Speaker Gasket.
	19C851636P2	Switchpad.
	19A705777P1	Nameplate.
		FRONT COVER 19D902072G9
	19D902072P10	Keypad.
	19D902072P14	Cable.
	19A116318P4	Foil, Magnetic Shielding: 1.50 inches wide.
	19A705664P1	Gasket.
	19D902072P34	Front cover.
	19D902072P36	Front cover.
	19D902072P41	Front cover.

SYMBOL	PART NO.	DESCRIPTION
A5		**LCD ASSEMBLY 19A705090G6**
		- - - - - - - - - - - - LEDS - - - - - - - - - -
H1	19C851660P2	Crystal display.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A703685P3	LCD connector.
	19B801569P1	Diffuser.
	19C851719P2	Lens.
A6		**CONTROL ASSEMBLY 19A705090G10**
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C3 thru C7	19A702052P3	Ceramic: 470 pF 10%, 50 VDCW.
		- - - - - - - - - - - - JACKS - - - - - - - - - - - -
J1	19A115834P1	Contact, electrical: sim to AMP 2-330808-8.
J3		Part of Control Frame 19A705733P4.
J901		Part of Control Frame 19A705733P4.
		- - - - - - - - - - - - METERS - - - - - - - - - -
M1	19A701301P3	Cartridge: Electret.
		- - - - - - - - - - - - SWITCHES - - - - - - - - -
S1	19A705712P1	Switch, subminiature.
S2	19A705712P2	Switch, subminiature.
S3 thru S7		Part of Control Frame 19A705733P4.
		- - - - - - - - - MISCELLANEOUS - - - - - - - - -
	19A705733P4	Control frame, circuitized.
	19B801571P2	Switch, dome.
	19C851722P1	Boot, auxilary jack.
		LCD DRIVER BOARD 19C851720G1
		- - - - - - - - - - CAPACITORS - - - - - - - - -
C1	19A702052P6	Ceramic: 1500 pF ±10%, 50 VDCW.
C2	19A702052P26	Ceramic: 0.1 µF ±10%, 50 VDCW.
		- - - - - - - - - - - - DIODES - - - - - - - - - -
D1 thru D4	19A705713P1	LED, subminiature.
		- - - - - - - - - - - - JACKS - - - - - - - - - - - -
J2		Part of printed wire board.
		- - - - - - - - - - - - PLUGS - - - - - - - - - - - -
P1	19B801235P13	Terminal strip.
P2	19B801235P3	Terminal strip.
		- - - - - - - - - - TRANSISTORS - - - - - - - - -
Q1	19A700059P2	Silicon, PNP: sim to MMBT3906, low profile.
Q2	19A700076P2	Silicon, NPN: sim to MMBT3904, low profile.
		- - - - - - - - - - RESISTORS - - - - - - - - - -
R1	19B801251P105	Metal film: 1M ohms ±5%, 1/10 w.
R2	19B801251P221	Metal film: 220 ohms ±5%, 1/10 w.
R3 and R4	19B801251P124	Metal film: 120K ohms ±5%, 1/10 w.
R5 and R6	19B801251P472	Metal film: 4.7K ohms ±5%, 1/10 w.
R7	19B801251P221	Metal film: 220 ohms ±5%, 1/10 w.
		- - - - - - - - INTEGRATED CIRCUITS - - - - - - -
U1	19A705714P1	CHIP, LCD drive.

PRODUCTION CHANGES

Changes in the equipment to improve performance or to simplify circuits are identified by a "Revision Letter", which is stamped after the model number of the unit. The revision stamped on the unit includes all previous revisions. Refer to the Parts List for the descriptions of parts affected by these revisions.

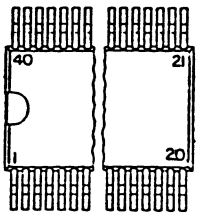
REV. A - **AUDIO/LOGIC BOARD 19D902631G1**

To improve radio performance and to allow use of a new VCO module. Changed R321.

R321 was 19A705496P6 - Variable: 50K ohms.

LCD DRIVER U1

19A705714P1



PINNING

SUPPLY

2 V_{DD} POSITIVE SUPPLY

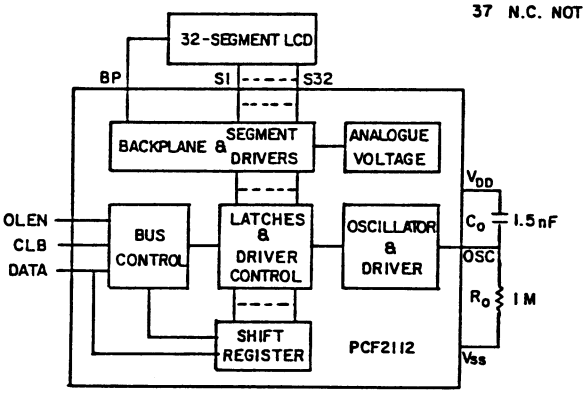
4 V_{SS} NEGATIVE SUPPLY

INPUTS

3 OSC OSCILLATOR INPUT
39 DATA DATA LINE
40 DLEN DATA LINE ENABLE
1 CLB CLOCK BURST
} CBUS

OUTPUTS

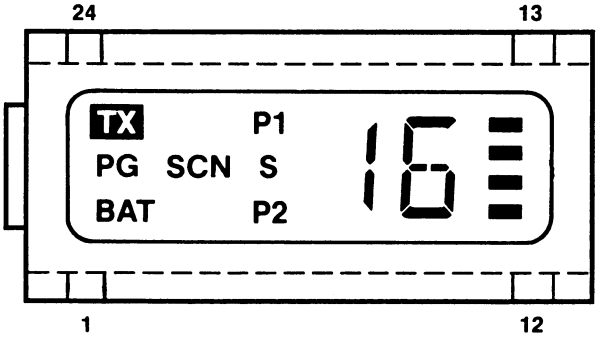
38 BP BACK PLANE DRIVER (COMMON OF LCD)
5 TO 36 LCD DRIVER OUTPUTS (S32 TO S1)
37 N.C. NOT CONNECTED



BLOCK DIAGRAM

LCD

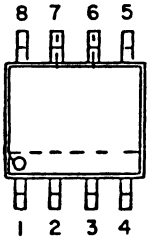
19C851660P2

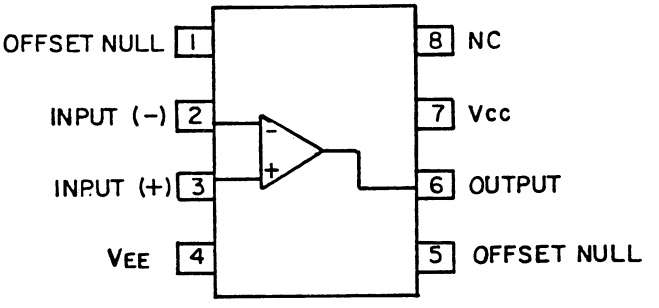


PIN OUT			
1	COM	13	NC
2	PG	14	BAR 2
3	BAT	15	BAR 3
4	SCN	16	BAR 4
5	P2	17	1B
6	ONE	18	1A
7	1E	19	1F
8	1D	20	1G
9	1C	21	P1
10	BAR 1	22	S
11	NC	23	TX
12	COM	24	COM

OPERATIONAL AMPLIFIER U301

19A705450P3

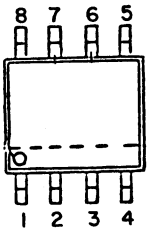


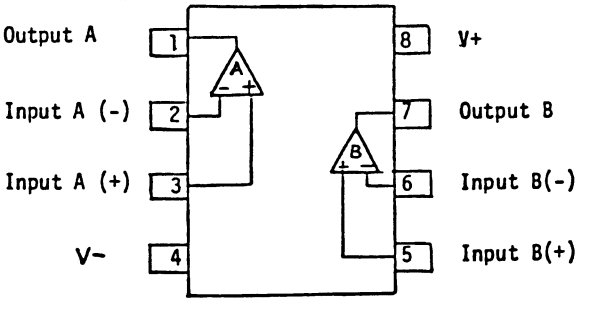


OPERATIONAL AMPLIFIER

U302/U703/U602

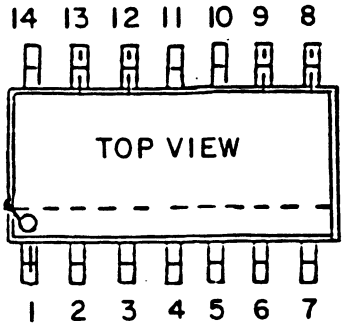
19A702293P2

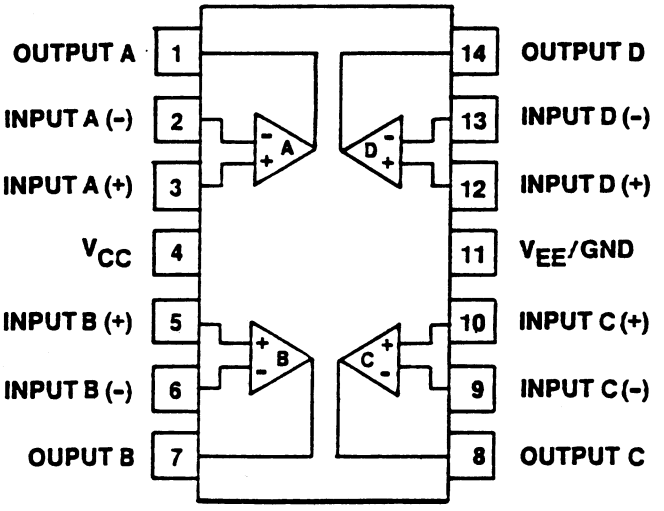




OPERATIONAL AMPLIFIER U601

19A702293P1



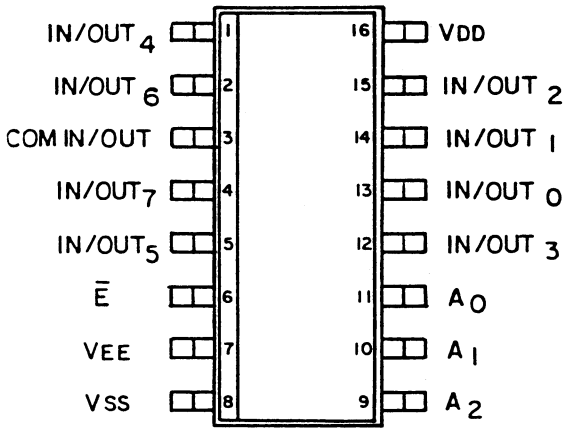


PIN 1 MAY BE IDENTIFIED BY INDENT OR CHAMFER

BILATERAL SWITCH U603

19A702705P3

PIN CONFIGURATION

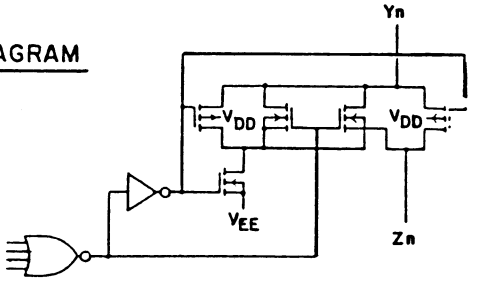


FUNCTION TABLE

INPUTS				CHANNEL ON
E	A_2	A_1	A_0	
L	L	L	L	Y_0-Z
L	L	L	H	Y_1-Z
L	L	H	L	Y_2-Z
L	L	H	H	Y_3-Z
L	H	L	L	Y_4-Z
L	H	L	H	Y_5-Z
L	H	H	L	Y_6-Z
L	H	H	H	Y_7-Z
H	X	X	X	NONE

H=HIGH STATE (THE MORE POSITIVE VOLTAGE)
L= LOW STATE (THE LESS POSITIVE VOLTAGE)
X=STATE IS IMMATERIAL

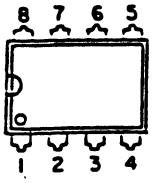
LOGIC DIAGRAM

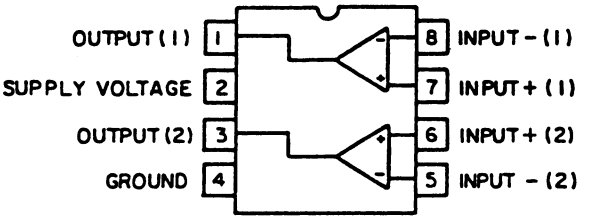


(ONLY 1/8 OF DEVICE SHOWN)

AUDIO AMPLIFIER U604

19A705452P1



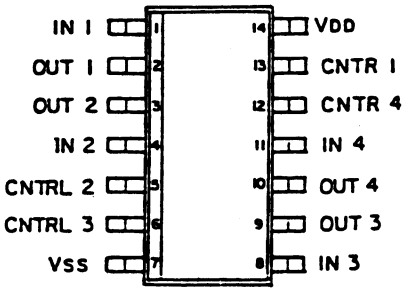


(TOP VIEW)

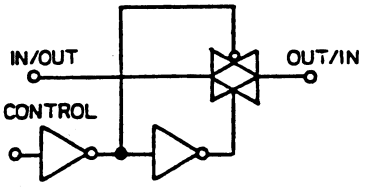
BILATERAL SWITCH U605

19A702705P1

PIN CONFIGURATION



LOGIC DIAGRAM

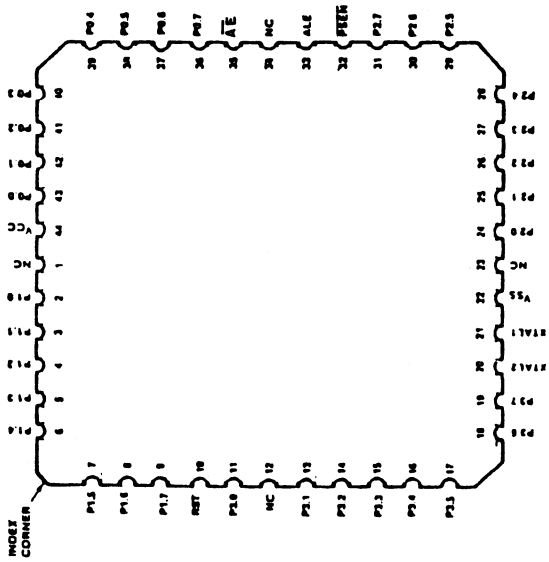


(1/4 OF DEVICE SHOWN)

CONTROL	SWITCH
0	OFF
1	ON

MICROPROCESSOR U1 (80C52)

19A705557P4



VSS		CIRCUIT GROUND POTENTIAL
VCC		+5V POWER SUPPLY
PORT 0		8—BIT OC BI-DIRECTIONAL I/O PORT.
PORT 1		8—BIT QUASI-BIDIRECTIONAL I/O PORT.
PORT 2		8—BIT QUASI-BIDIRECTIONAL I/O PORT.
PORT 3		8—BIT QUASI-BIDIRECTIONAL I/O PORT.
	3.0	RXD — SERIAL PORT RECEIVER DATA.
	3.1	TXD — SERIAL PORT TRANSMITTER DATA.
	3.2	INT0 — INTERRUPT 0 INPUT.
	3.3	INT1 — INTERRUPT 1 INPUT.
	3.5	T1 — COUNTER 1 INPUT.
	3.6	WR — WRITE CONTROL.
	3.7	RD — READ CONTROL.
RST		RESET.
ALE		ADDRESS LATCH ENABLE.
PSEN		PROGRAM STORE ENABLE OUTPUT.
EA		INTERNAL/EXTERNAL INSTRUCTION FETCH.
XTAL1		INPUT TO OSCILLATOR AMPLIFIER.
XTAL2		OUTPUT FROM OSCILLATOR AMPLIFIER.

FUNCTION DIAGRAM